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ORIGINAL

FLOOD INSURANCE STUDY

COMPLETED /00

PIERCE COUNTY, WASHINGTON
UNINCORPORATED AREAS

VOLUME 1 OF 2

AUGUST 19, 1987

Federal Emergency Management Agency

COMMUNITY NUMBER - 530138

NOTICE TO FLOOD INSURANCE STUDY USERS

Communities participating in the National Flood Insurance Program have established repositories of flood hazard data for flood plain management and flood insurance purposes. This Flood Insurance Study may not contain all data available within the repository. It is advisable to contact the community repository for any additional data.

TABLES OF CONTENTS

Table of Contents--Volume 1

Page

1.0 INTRODUCTION 1

1.1 Purpose of Study 1
1.2 Authority and Acknowledgments 1
1.3 Coordination 1

2.0 AREA STUDIED 2

2.1 Scope of Study 2
2.2 Community Description 6
2.3 Principal Flood Problems 7
2.4 Flood Protection Measures 14

3.0 ENGINEERING METHODS 15

3.1 Hydrologic Analyses 15
3.2 Hydraulic Analyses 24

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS 27

4.1 Flood Boundaries 27
4.2 Floodways 28

5.0 INSURANCE APPLICATION 65

5.1 Reach Determinations 65
5.2 Flood Hazard Factors 65
5.3 Flood Insurance Zones 75
5.4 Flood Insurance Rate Map Description 76

6.0 OTHER STUDIES 76

7.0 LOCATION OF DATA 77

8.0 BIBLIOGRAPHY AND REFERENCES 77

Table of Contents--Volume 1 (Cont'd)

Page

FIGURES

Figure 1 - Vicinity Map.......... 3
Figure 2 - Historic Flooding.......... 9
Figure 3 - Historic Flooding.......... 10
Figure 4 - Historic Flooding.......... 11
Figure 5 - Historic Flooding.......... 11
Figure 6 - Historic Flooding.......... 12
Figure 7 - Historic Flooding.......... 13
Figure 8 - Floodway Schematic.......... 64

TABLES

Table 1 - Summary of Discharges.......... 17
Table 2 - Summary of Elevations.......... 25
Table 3 - Floodway Data.......... 30
Table 4 - Flood Insurance Zone Data.......... 66

EXHIBITS

Exhibit 1 - Flood Profiles

Leach Creek Panels 01P-02P
Chambers Creek Panels 03P-06P
Clover Creek Panels 07P-10P
Spanaway Creek Panels 11P-12P
North Fork Clover Creek Panels 13P-14P

Table of Contents--Volume 2

Nisqually River Panels 15P-24P
Horn Creek Panels 25P-27P
Ohop Creek Panels 28P-32P
Mashel River Panels 33P-34P
Little Mashel River Panels 35P-42P
Unnamed Creek Panels 43P-44P
Tanwax Creek Panels 45P-46P
South Creek Panels 47P-50P
South Creek Tributary No. 1 Panels 51P-52P
South Creek Tributary No. 2 Panel 53P
South Creek Tributary No. 3 Panel 54P
South Creek Tributary No. 4 Panel 55P
Muck Creek Panels 56P-57P
Lacamas Creek Panels 58P-61P
Puyallup River Panels 62P-73P
Swan Creek Panels 74P-76P
Squally Creek Panels 77P-78P

Table of Contents-Volume 2 (Cont'd)

Clear Creek Panels 79P-81P
Wapato Creek I Panels 82P-86P
Wapato Creek II Panel 87P
Hylebos Creek Panels 88P-89P
White River Panels 90P-95P
Salmon Creek Panels 96P-97P
Carbon River With Consideration of Levees Panels 98P-101P
Carbon River Without Consideration of Levees Panels 102P-104P
South Prairie Creek Panels 105P-108P
Greenwater River Panels 109P-111P
Wilkeson Creek Panel 112P
Fennel Creek Panel 113P
Debra Jane Creek Panel 114P
Bonney Lake Outflow Panel 115P
Muck Creek (at Roy) Panels 116P-117P

Exhibit 2 - Flood Boundary and Floodway Map Index
Flood Boundary and Floodway Map

PUBLISHED SEPARATELY:

Flood Insurance Rate Map Index
Flood Insurance Rate Map

FLOOD INSURANCE STUDY

1.0 INTRODUCTION

1.1 Purpose of Study

This Flood Insurance Study investigates the existence and severity of flood hazards in the unincorporated areas of Pierce County, Washington, and aids in the administration of the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973. This study has developed flood risk data for various areas of the community that will be used to establish actuarial flood insurance rates and assist the community in its efforts to promote sound flood plain management. Minimum flood plain management requirements for participation in the National Flood Insurance Program (NFIP) are set forth in the Code of Federal Regulations at 44 CFR, 60.3.

In some states or communities, flood plain management criteria or regulations may exist that are more restrictive or comprehensive than the minimum Federal requirements. In such cases, the more restrictive criteria take precedence and the State (or other jurisdictional agency) will be able to explain them.

1.2 Authority and Acknowledgments

The sources of authority for this Flood Insurance Study are the National Flood Insurance Act of 1968 and the Flood Disaster Protection Act of 1973.

The hydrologic and hydraulic analyses for this study were performed by the U.S. Geological Survey (USGS), for the Federal Emergency Management Agency (FEMA), under Inter-Agency Agreement No. IAA-H-8-76, Project Order No. 4. This study was completed in October 1980.

In addition to the work done by the USGS, Dames & Moore revised the hydraulic analyses for the Puyallup and Carbon Rivers using more up-to-date information provided by the U.S. Army Corps of Engineers (COE). This work was performed under Contract No. C-0542. This study was completed in December 1983.

1.3 Coordination

Streams requiring detailed and approximate study were identified at meetings attended by representatives of the study contractor, the Washington State Department of Ecology, FEMA, and Pierce County. These meetings were held in Tacoma, Washington, on January 14 and May 19, 1975. The final community coordination meeting, attended by the above-mentioned parties, was held on June 18, 1985. All problems raised at that meeting have been resolved.

Coordination with Pierce County was maintained throughout the study.

2.0 AREA STUDIED

2.1 Scope of Study

This Flood Insurance Study covers the unincorporated areas of Pierce County, Washington. The area of study is shown on the Vicinity Map (Figure 1).

Areas not included in this study are the Cities of Buckley, Fife, Orting, Puyallup, Steilacoom, Sumner, and Tacoma; the Towns of Bonney Lake, Carbonado, Dupont, Eatonville, Fircrest, Gig Harbor, Milton, Roy, Ruston, South Prairie, and Wilkeson; and the Nisqually Indian Reservation.

Flood and floodway boundaries base flood elevations, zone designations, cross sections and flood profiles are shown within portions of some incorporated communities. This data is included in this study to provide complete coverage in areas of the communities annexed since publication of their Flood Insurance Studies. This data is also shown within the Nisqually India Reservation to provide coverage for areas that are no longer within Bureau of India Affairs jurisdictiion.

Streams in Pierce County that were studied by detailed methods are as follows:

Leach Creek from the mouth upstream for 2.6 miles

Chambers Creek from the outlet of Steilacoom Lake downstream for 2 miles

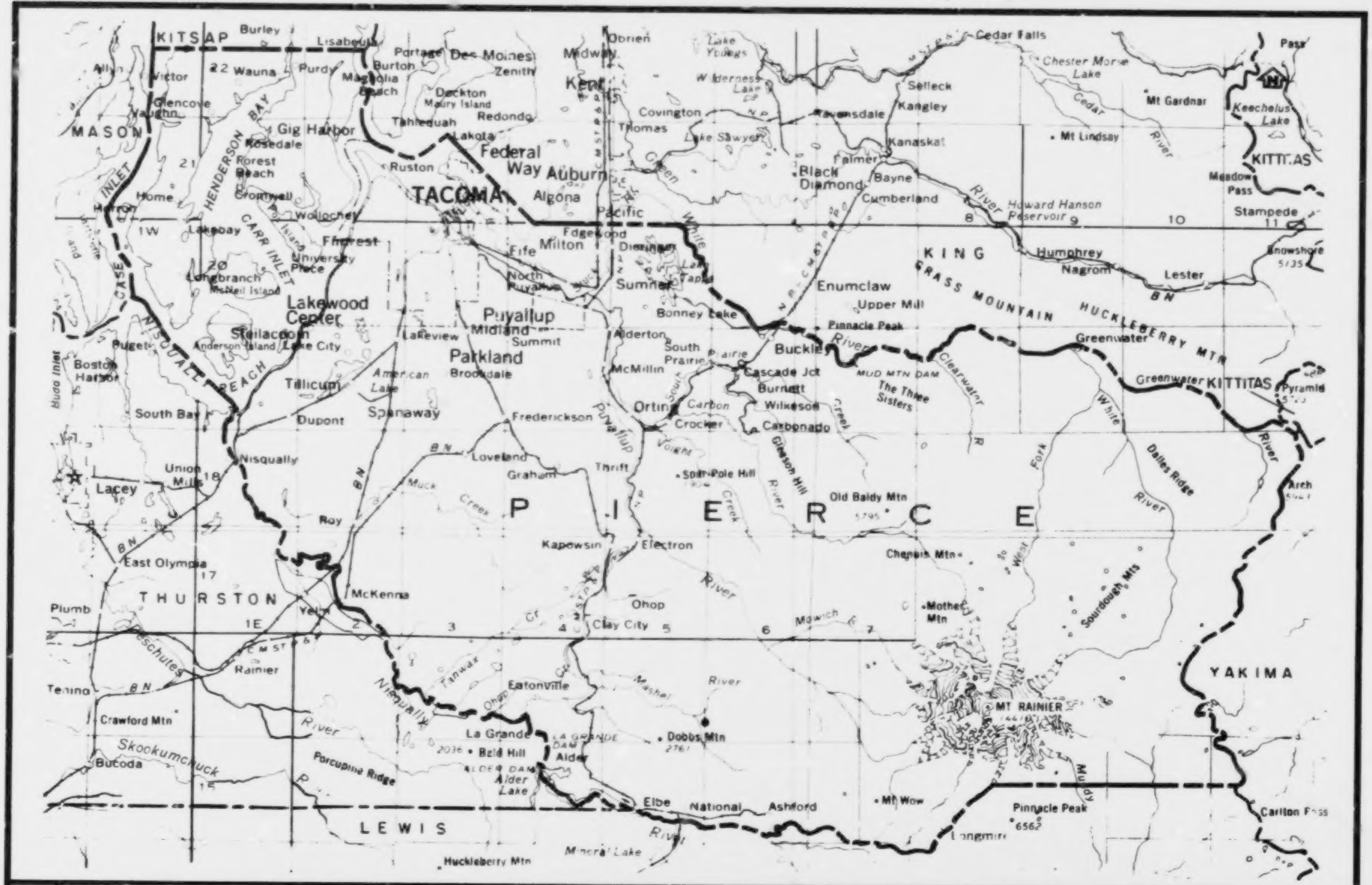
Clover Creek from the mouth upstream to the community of Frederickson excluding the portion of the stream that flows through McChord Air Force Base

Spanaway Creek from the mouth upstream to Spanaway Lake

North Fork Clover Creek from the mouth upstream for 1.0 mile and 0.4 mile upstream along North Fork Clover Creek Tributary No. 1 (for purpose of this study, the two streams were treated as one flooding source and are referred to as North Fork Clover Creek).

Nisqually River from the mouth upstream to the confluence with Ohop Creek and from the Snoqualmie National Forest boundary to the Mt. Rainier National Park boundary

Horn Creek from the mouth upstream to Harts Lake Loop Road (approximately 3.5 miles)



KITSAP
MASON
KING
KITTITAS
PIERCE
THURSTON
LEWIS
YAKIMA
TACOMA
Federal Way
Auburn
Kent
Des Moines
Gig Harbor
Lakewood Center
Puyallup
Parkland
Sumner
Enumclaw
Buckley
Orting
Eatonville
Steilacoom
Spanaway
Lacey
Mt Rainier
Black Diamond
Algona
Pacific
Milton
Fife
Edgewood
Bonney Lake
Alderton
South Prairie
Wilkeson
Carbonado
Dupont
Roy
Yelm
McKenna
Kapowsin
Electron
Elbe
Ashford
Longmire
Alder
La Grande
Nisqually
Graham
Frederickson
Summit
Midland
Tillicum
Dobbs Mtn
Old Baldy Mtn
Grass Mountain
Huckleberry Mtn
Greenwater
Mud Mtn Dam
Alder Lake
Carr Inlet
Henderson Bay
Case Inlet
Nisqually Reach
Stampede Pass
Keechelus Lake
Howard Hanson Reservoir
Chester Morse Lake
Cedar Falls
Carlton Pass
Pinnacle Peak

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

APPROXIMATE SCALE

8 0 8 16 24 MILES

FIGURE 1

VICINITY MAP

Ohop Creek from the mouth upstream to Kapowsin Lake

Mashel River from the confluence with the Little Mashel River upstream for 2.4 miles

Little Mashel River from the confluence with the Mashel River upstream for 2.4 miles

Unnamed Creek between Kreger and Silver Lakes

Tanwax Creek from 0.5 mile upstream of the Eatonville Cutoff Road upstream to Tanwax Lake (3.8 miles)

South Creek from 1 mile downstream of U.S. Highway 7 upstream to the Kapowsin Highway crossing (6.4 miles) and 6.6 miles of streams tributary to South Creek

Muck Creek from U.S. Highway 7 upstream for 3.5 miles, and from 0.4 mile downstream to 0.1 mile upstream of the Town of Roy (for purposes of this study, the former reach is referred to as Muck Creek, the latter as Muck Creek (at Roy)

Lacamas Creek from the corporate limits of the Town of Roy upstream for 8 miles

Puyallup River from the corporate limits of the City of Tacoma upstream for 28.5 miles to the community of Electron

Swan Creek from the mouth upstream for 2.6 miles

Squally Creek from the mouth upstream for 1.1 miles

Clear Creek from the confluence with the Puyallup River upstream for 3.8 miles

Wapato Creek I from the mouth at Blair Waterway upstream to the Union Pacific Railroad near Cedarhurst Road East

Wapato Creek II from the mouth at the Puyallup River upstream for 1.9 miles

Hylebos Creek from the corporate limits of the City of Tacoma upstream to the corporate limits of the Town of Milton

White River from the mouth upstream for 5 miles to the corporate limits of Pierce County, 0.4 mile near the City of Buckley and from the confluence with the Greenwater River upstream for 4.3 miles

Salmon Creek from the mouth upstream for 1.7 miles

Carbon River from the mouth upstream for approximately 8 miles

South Prairie Creek from the mouth upstream to the eastern corporate limits of the Town of South Prairie

Greenwater River from the mouth upstream for 3 miles

Wilkeson Creek from the Burlington Northern Railroad upstream for 0.3 mile to the corporate limits of the Town of Wilkeson and from the southern corporate limits of the Town of Wilkeson upstream for 0.3 mile

Fennel Creek from State Highway 410 upstream to the confluence with Debra Jane Creek

Debra Jane Creek from the mouth upstream for 0.3 mile to the Bonney Lake corporate limits

Bonney Lake Outflow for 0.1 mile formerly within Pierce County

The lakes studied in detail were: Harts, Little, Kreger, Silver, Rapjohn, Steilacoom, American, Gravelly, Louise, Spanaway, Kapowsin, Tanwax, Ohop, and Clear.

Also studied in detail were the tidal areas of Puget Sound at Nisqually Reach, Day Island, and Commencement Bay.

The areas studied by detailed methods were selected with priority given to all known flood hazard areas and areas of projected development or proposed construction through October 1985.

Flett Creek was originally studied by detailed methods from the mouth upstream to the corporate limits of the City of Tacoma. After this analysis was completed, the drainage basin was altered at Tacoma. The effect of this change on the downstream portion of Flett Creek was not determined; therefore, the area in Pierce County was changed to an approximate designation.

The approximate method of analysis was used to study parts of Tanwax, Wilkeson, Muck, South, Horse Haven, and Voight Creeks and the Mashel River.

Approximate analyses were used to study those areas having a low development potential or minimal flood hazards. The scope and methods of study were proposed to, and agreed upon by, FEMA and Pierce County.

2.2 Community Description

Pierce County is located in western Washington, near the southern end of the Puget Sound. It is bordered by the counties of Yakima on the east, King and Kitsap on the north, Mason and Thurston on the west, and Lewis on the south. The area of Pierce County is 1,676 square miles. Its 1979 population was 453,900, of which 243,062 resided in the unincorporated areas (Reference 1). Tacoma, in northwest Pierce County, is the largest of 18 incorporated cities in the county and is the county seat.

The four main rivers in Pierce County are the Nisqually, Puyallup, White, and Carbon. The White and Carbon Rivers are major tributaries to the Puyallup River.

The Nisqually River, which originates from glaciers on Mount Rainier, forms the majority of the western and southern boundaries of Pierce County from Puget Sound to Mt. Rainier. The Puyallup River emerges from glaciers on the western slopes of Mt. Rainier and discharges into Commencement Bay at the City of Tacoma.

The Puyallup River valley south of the City of Orting has a slope of approximately 45 feet per mile, whereas the valley slope at Orting decreases to approximately 25 feet per mile. Decreases in channel slope tend to reduce the ability of a stream or river to transport sediment. Therefore, it is likely that some of the sediment carried by the Puyallup River in the steep valley upstream of Orting is deposited near Orting. Although no sedimentation studies have been conducted in the area to determine how much, if any, sediment has been deposited in the channel over the years, the fact that the riverbed is as much as 5 feet higher than parts of the flood plain outside the channel levees indicates there has been a substantial amount of material deposited.

The White River is a glacier-fed stream that rises on the northeastern slopes of Mt. Rainier and discharges into the Puyallup River at River Mile 10.4 near Sumner.

The Carbon River emerges from Carbon Glacier on the northern slopes of Mt. Rainier and discharges into the Puyallup River downstream of Orting at River Mile 17.9.

The topography of Pierce County is diverse, and the range of changes in elevation of land surface is extreme. The terrain changes from flat or moderately hilly around the inlets of Puget Sound in the northwestern part of the county, to rolling uplands toward the central part and foothills and mountainous areas in the southeast. The elevation of land around the Puget Sound inlets ranges from near sea level to only a few hundred feet above sea level. The land elevation increases in the southeasterly direction, reaching a maximum of 14,410 feet at the top of Mt. Rainier. The soils of Pierce County were derived from a wide variety of sources, including glacial till and outwash, lake sediment, stream alluvium, and weathered bedrock (Reference 2).

Vegetation consists mainly of evergreen conifers such as Douglas fir, hemlock, and cedar trees. There are lesser stands of deciduous trees and a considerable amount of understory plants (Reference 2).

The climate of Pierce County is predominately marine type, with moist airmasses reaching Puget Sound from the Pacific Ocean. The maritime air has a moderating influence in both winter and summer. There is a well-defined dry season in summer and a rainy season in winter (Reference 3). Mean annual precipitation increases from 39 inches at the City of Tacoma in the Puget Sound area to 71 inches at the community of Electron and 204 inches at Paradise Ranger Station on Mt. Rainier. Winter snowfall ranges from 11 inches at Tacoma to 587 inches at Paradise Ranger Station. Seventy-five percent of the precipitation falls from October through March. Mean annual temperatures range from 51°F at Tacoma to 46°F at Electron and 38°F at Paradise Ranger Station. The highest monthly mean temperatures are in July and the lowest are in January, with ranges for Tacoma, Electron, and Paradise of 64°F-39°F, 60°F-34°F, and 53°F-26°F, respectively (Reference 4).

2.3 Principal Flood Problems

Major floods occur from October through March as a result of rainstorms, which are often augmented by melting snows.

Flood damage along the Nisqually River is generally limited to an area near the community of McKenna at River Mile 21.8 (Reference 5) and to the Nisqually Delta, which is a wide 3-mile-long flood plain at the mouth of the river. The land from McKenna to LaGrande Dam has a narrow flood plain with limited access. Approximately 18,000 cubic feet per second (cfs) in the Nisqually River at McKenna is considered to represent the upper limit of zero flood damage (Reference 6). This flow has been exceeded six times during the period of record (1947-78) at the USGS gaging station on the Nisqually River below Powell Creek near McKenna (gage no. 12088400) at River Mile 31.6. At this station, the three most severe floods occurred in December 1975 (30,700 cfs), January 196[illegible] (25,700 cfs), and January 1974 (23,200 cfs) (References 7-11). An estimated flood of 42,000 cfs at the same site occurred in December 1933, inundating most of the delta (Reference 12).

Major floods on the Puyallup River were recorded 18 times at the City of Puyallup between 1914 and 1943, before Mud Mountain Dam was completed. The largest flood, 57,000 cfs, occurred on December 10, 1933. The river has not exceeded zero flood damage flow (45,000 cfs at Puyallup) since the Mud Mountain Dam was completed in 1943. It is estimated that the natural peak flow of the January 1965 flood would have been 53,000 cfs, but the Mud Mountain Project reduced it to 41,500 cfs (Reference 12). Major flood damage still occurs in the vicinity of the Town of Orting, where the channel capacity of the Puyallup River has been exceeded frequently. The largest flood recorded at the gaging station near Orting (gage no. 12093500) at River Mile 26.4 was 15,300 cfs in November 1962 (References 7-11). In December 1977, major damage occurred in the communities of Alderton and McMillin because of high flows on the Puyallup River.

The only extensive flood plains on the White River are located in the Sumner area at the mouth. Mud Mountain Dam, at River Mile 29.6, has regulated floodflows on the lower White River so as not to exceed 20,000 cfs and has thus limited major damage.

Most of the flood damage from the Carbon River occurs in the lower 4-mile reach in the vicinity of Orting. The steep gradient of the river upstream of Orting causes high velocities that erode the streambanks and result in channel changes during high flows. The channel capacity in the Orting area is estimated at 6,000 cfs (Reference 6). The largest flood recorded at the USGS gaging station at Fairfax (gage no. 12093900) at River Mile 17.7 was 10,000 cfs in December 1977.

Clear and Clarks Creeks enter the Puyallup River at River Miles 2.9 and 5.8, respectively. High water on the Puyallup River prevents normal drainage and results in backwater covering the low-lying lands in the flood plains behind the dikes of the Puyallup River.

Annual peak-discharge data for Muck Creek at Roy were recorded at a streamflow gaging station (No. 12090200) operated by the U.S. Geological Survey from 1957 to 1976. The gage was located on the north bank of Muck Creek between Warren Street and the Burlington Northern Railroad. The highest annual peak discharge recorded at the gage was 692 cubic feet per second (cfs) on March 7, 1972. The recurrence interval of that peak is estimated to be approximately 17 years. No flooding resulted from the 1972 peak, according to reports from local residents. The maximum known flood in Roy occurred in December 1933. Peak discharges and recurrence inter intervals for this flood are unknown. The area upstream from the Burlington Northern Railroad bridge and the Warren Street bridge (located in Roy) is especially prone to flooding due to the constrictions in the flood plain caused by these bridges.

Figure 2 shows tidal flooding of approximately a 100-year recurrence interval on Day Island in December 1977. Figures 3-7 show flooding along the Puyallup River on December 2, 1977; estimated recurrence interval was 22 years.

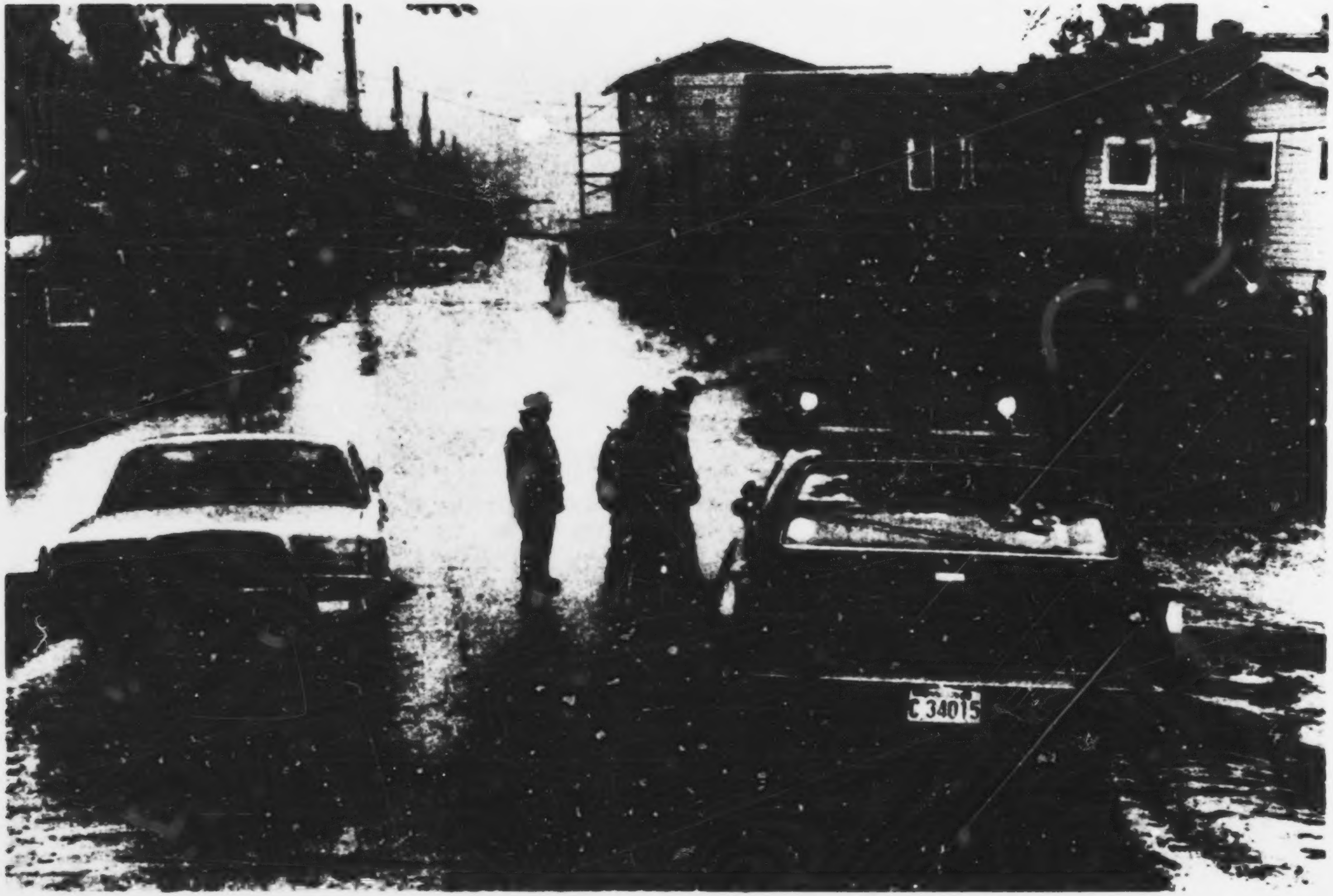


Figure 2. Looking South Along Day Island Boulevard West on Day Island During the December 15, 1977, High Tide of Puget Sound (Courtesy of Tacoma News Tribune)

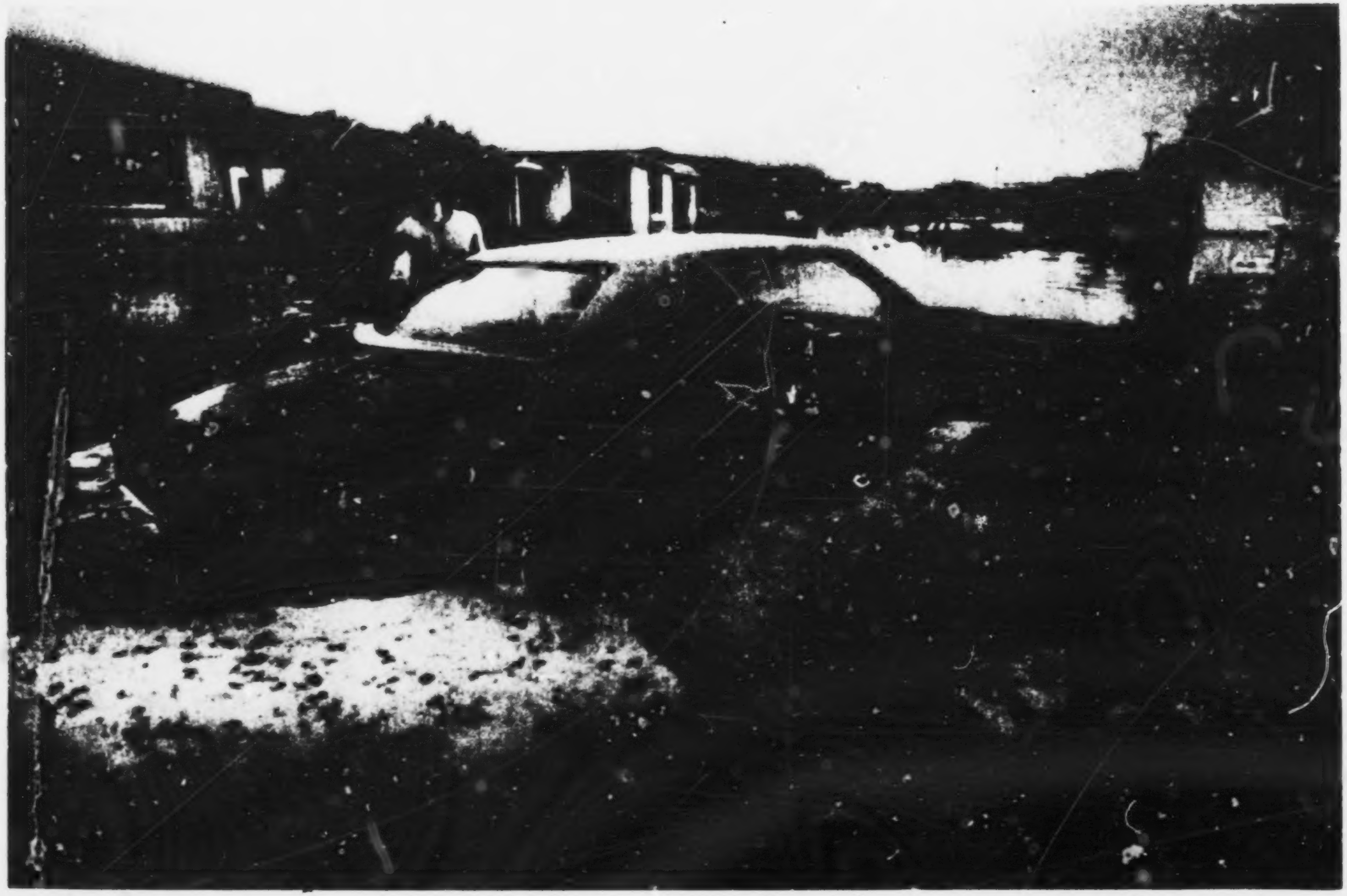


Figure 3. Flooding from the Puyallup River in the Alderton Area Near River Mile 12.2 in December 1977 (Courtesy of Tacoma News Tribune)

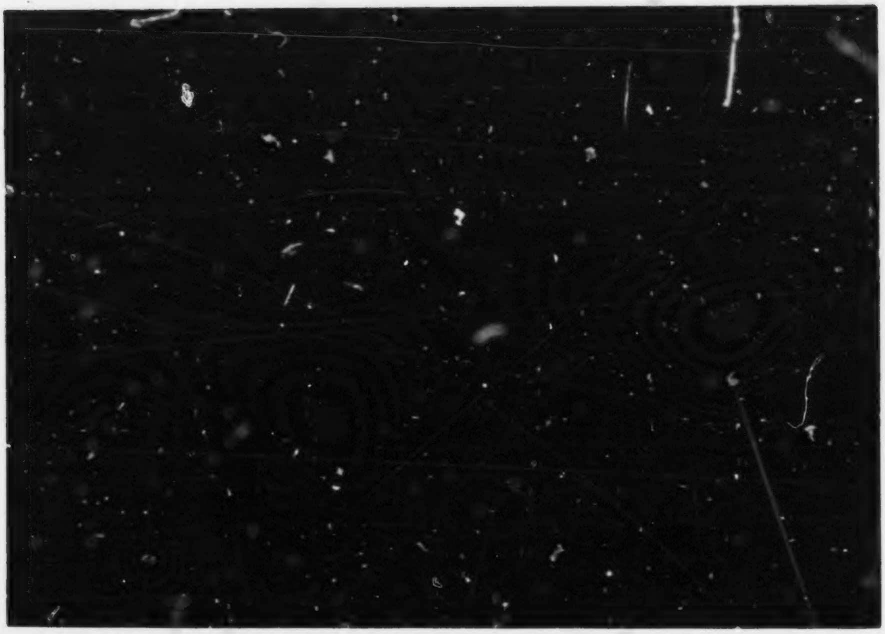


Figure 4. Flooding from the Puyallup River in the McMillan Area Near River Mile 17.0 in December 1977 (Courtesy of Pierce County)

Figure 5. Flooding from the Puyallup River in the Bowmen Hilton Area near the City of Puyallup in December 1977 (Courtesy of Pierce County)

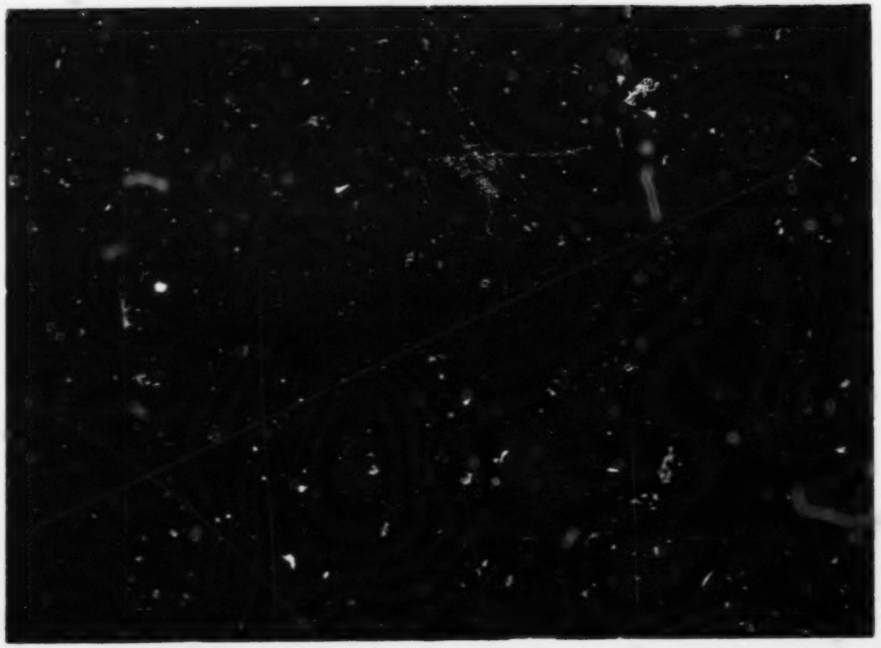


Figure 6. Flooding from the Puyallup River 0.5 mile upstream from the City of Sumner in December 1977 (Courtesy of Pierce County)

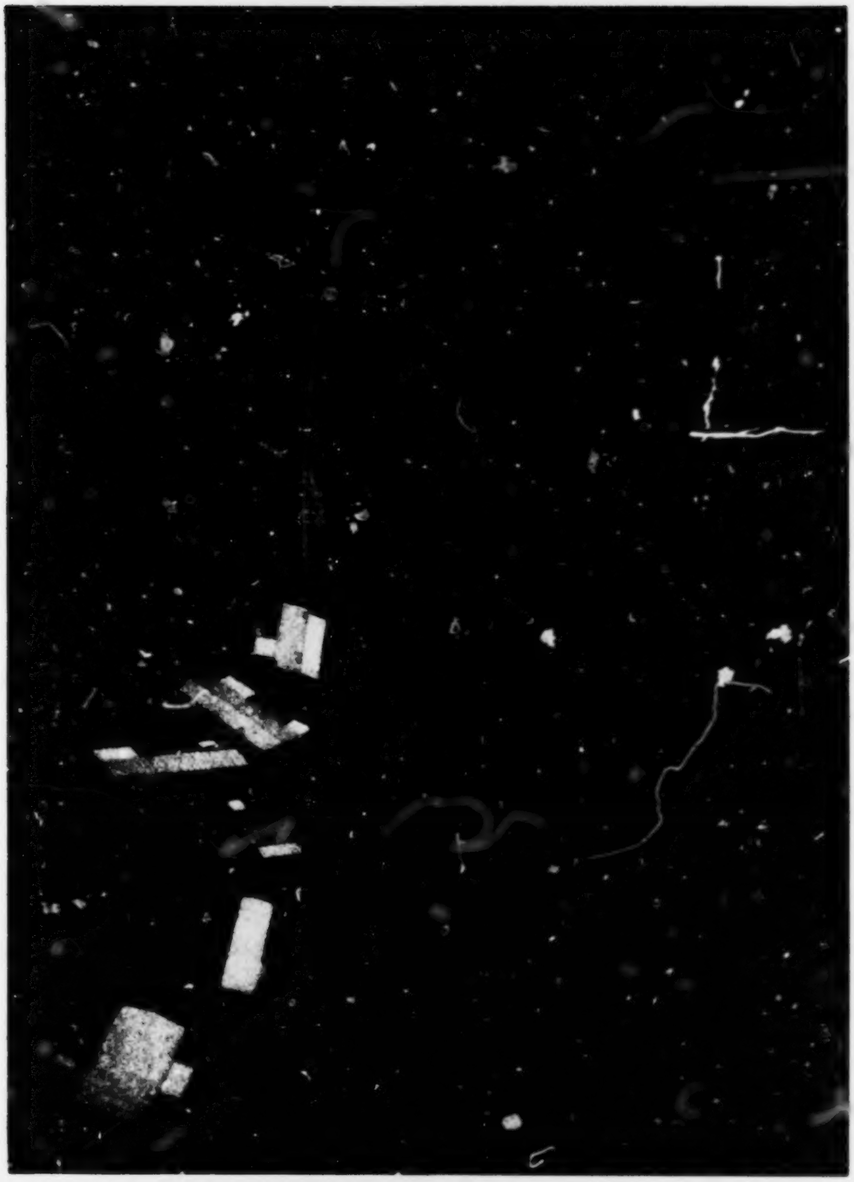


Figure 7. Flooding from the Puyallup River in the City of Sumner in December 1977 (Courtesy of Pierce County)

2.4 Flood Protection Measures

Two reservoirs with a combined storage capacity of 234,700 acre-feet (Alder Reservoir, 232,000 acre-feet, and LaGrande Reservoir, 2,700 acre-feet) are located in the Nisqually River basin. AdeAdequate flood-control storage is not provided by either reservoir. However, it is estimated that the Alder Reservoir is able to store up to 15,000 acre-feet of floodwater and thus reduce the magnitude of floods below Alder Dam by approximately 5,000 cfs (Reference 6).

Mud Mountain Dam, located at River Mile 29.6 on the White River, has a storage capacity of 106,000 acre-feet and is operated exclusively for flood control. The dam regulates floodflows to within bank flows, allowing a maximum of 20,000 cfs in the White River in the Sumner area, and 45,000 cfs in the Puyallup River downstream of Sumner (Reference 12).

Levees that provide protection from the 100-year flood have been constructed along the Puyallup River from the mouth upstream to just upstream of 15th Street NW. These levees have 3 feet of freeboard with respect to the 100-year flood and are jointly maintained by the Inter-County and Pierce County River Improvement Projects.

Levees also exist along the Puyallup River upstream of 15th Street NW and along the Carbon River. These levees provide the community with some degree of protection from flooding. However, it has been ascertained that these levees may not protect the community from rare events such as the 100-year flood. The criteria used to evaluate protection from the 100-year flood are (1) adequate design, including freeboard; (2) structural stability; and (3) proper operation and maintenance. Levees that do not protect from the 100-year flood are not considered in the hydraulic analysis of the 100-year flood plain.

Intermittent levees are located along the Puyallup River from 15th Street NW upstream to the community of Electron. These levees provide less than 3 feet of freeboard between the top of the levee and the 100-year flood and are not properly maintained. Furthermore, the degree of flood protection now provided from lesser frequency floods is expected to decrease as additional sediment is deposited in the channel.

Levees along the Carbon River from the mouth at the Puyallup River to State Highway 162 provide more than 3 feet of freeboard with respect to the 100-year flood; however, due to insufficient information regarding maintenance of the levees, they have not been credited with providing protection from the 100-year flood. Upstream of State Highway 162, levees along the Carbon River are intermittent and do not provide the 100-year protection.

Although several methods of increasing flood protection from the Puyallup River have been proposed during the past decade, none of them have been undertaken. A 1974 study by the COE included proposals such as raising existing levees, constructing new levees outside the existing ones, constructing a ring levee around Orting, and removing gravel from the channel (Reference 13).

Limited regulation of flood plain development is provided by the Shoreline Management Program of Pierce County and the Washington State Department of Ecology.

3.0 ENGINEERING METHODS

For the flooding sources studied in detail in the community, standard hydrologic and hydraulic study methods were used to determine the flood hazard data required for this study. Flood events of a magnitude which are expected to be equaled or exceeded once on the average during any 10-, 50-, 100-, or 500-year period (recurrence interval) have been selected as having special significance for flood plain management and for flood insurance rates. These events, commonly termed the 10-, 50-, 100-, and 500-year floods, have a 10, 2, 1, and 0.2 percent chance, respectively, of being equaled or exceeded during any year. Although the recurrence interval represents the long-term average period between floods of a specific magnitude, rare floods could occur at short intervals or even within the same year. The risk of experiencing a rare flood increases when periods greater than 1 year are considered. For example, the risk of having a flood which equals or exceeds the 100-year flood (1 percent chance of annual exceedence) in any 50-year period is approximately 40 percent (4 in 10), and, for any 90-year period, the risk increases to approximately 60 percent (6 in 10). The analyses reported herein reflect flooding potentials based on conditions existing in the community at the time of completion of this study. Maps and flood elevations will be amended periodically to reflect future changes.

3.1 Hydrologic Analyses

Hydrologic analyses were carried out to establish the peak discharge-frequency relationships for each riverine flooding source studied in detail affecting the community.

The peak discharge-frequency relationships for streams studied by detailed methods were computed from regression equations that relate peak discharge-frequency data to drainage area and mean annual precipitation. Drainage area and annual peak-discharge data for 53 continuous-record and 14 partial-record gaging stations (References 7-11, and 14-16 and mean annual precipitation data associated with each drainage area (Reference 17) were used in the development of the regression equations. The gaging stations, operated by the USGS from as early as 1914, are located in Pierce and Thurston Counties. For Muck Creek (at Roy), data from 25 gaging stations

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were used. Among the 25 gaging stations, one was located on Muck Creek at Roy. The number of years of peak-discharge record for the individual gaging stations ranged from 6 to 34 years with 6 stations having less than 10 years, 11 having 10 to 20 years, and 8 having more than 20 years. Peak discharge-frequency relationships were determined for each peak-discharge record by using the standard log-Pearson Type III method of analysis as outlined by the Water Resources Council (Reference 18).

Regional peak discharge-frequency relationships that were developed previously (References 19 and 20) were investigated before developing the regression equations used in this study. However, these relationships were not used because additional peak-discharge data have since become available, the log-Pearson Type III method of analysis has since been improved and standardized, and relationships for a smaller region were needed to more accurately reflect localized floodflow conditions.

Peak discharge-drainage area relationships for the streams studied by detailed methods are shown in Table 1.

Analyses were carried out to establish the peak elevation-frequency relationships for the remaining flooding sources studied in detail.

Regional relationships were developed for estimating the differences between mean lake elevation and the 10-, 50-, 100-, and 500-year peak elevations, based on log-Pearson Type III analysis (Reference 18). Elevation records collected on Ohop Lake from 1960 to 1975, on Tanwax Lake from 1962 to 1975, and on seven other lakes in western Washington with similar hydrologic settings (References 7-11) were used as a source of data for this analysis. These relationships were applied to determine the flood-peak elevations for 12 lakes in Pierce County by adding difference values to lake elevations at time of photography, which were considered to be at the mean levels.

Elevations for Steilacoom Lake are controlled by culverts at the outlet of the lake, and the elevations for the selected recurrence intervals were developed from a culvert rating using discharges from the peak discharge-frequency relationships for Chambers Creek.

The peak tidal elevation-frequency relationship for floods along the Puget Sound shoreline was developed by analyzing 71 years of annual peak tidal elevations at the Seattle Tidal Station, obtained from the National Oceanic and Atmospheric Administration in 1975, with the log-Pearson Type III method (Reference 17), using 0.2 skew. Values of the 10-, 50-, 100-, and 500-year peak tidal elevations were then transferred from Seattle to Commencement Bay, Day Island, and the Nisqually Reach by applying adjustments determined from tide prediction tables (Reference 21).

Table 1. Summary of Discharges

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Leach Creek					
At Bridgeport Way	7	125	205	245	380
At South 40th Street	5	90	160	200	325
Chambers Creek					
At the Downstream Limit of Detailed Study	106	756	1,070	1,200	1,530
At Cross Section Z	90	671	945	1,060	1,360
Flett Creek					
At Mouth	7	109	150	169	211
Upstream of the Corporate Limits in Tacoma, Washington	6	84	115	129	160
Clover Creek					
At Mouth	48	408	618	693	863
At Cross Section AI	32	292	446	496	606
At 136th Street South	21	158	228	260	332
At Waller Road	12	98	140	158	201
At Grieler Road	8	73	104	118	148
Spanaway Creek					
At Spanaway Loop Road	10[1]	74	106	120	154
At Military Road	--[2]	147	212	241	308
North Fork Clover Creek					
At Mouth	6	176	195	202	218

[1] Discharges Reflect Distributary Flow
[2] Not Available

Table 1. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Nisqually River					
At Mouth[1]	711	21,500	29,000	33,000	45,000
Upstream of Horn Creek (Cross Section DO)[1]	488	21,000	28,000	32,000	44,000
Upstream of Tanwax Creek (Cross Section EL)[1]	446	20,500	27,000	31,000	43,000
At Skate Creek Road	79	6,250	9,080	10,400	13,600
At Mt. Rainier National Park Boundary	66	5,400	7,910	9,040	11,900
Horn Creek					
At Mouth	15	192	266	299	376
At Hart's Lake Loop Road (8th Avenue South)	7	113	155	174	217
Ohop Creek					
At Mouth	44	953	1,345	1,518	1,945
At Kapowsin Eatonville Road	35	893	1,259	1,421	1,820
Upstream of the Confluence with Lynch Creek	18	440	615	690	880
Upstream of the Confluence with Ohop Lake	13	364	507	572	724
Downstream of the Confluence with Twenty-five Mile Creek	10	334	465	524	663
Upstream of the Confluence with Twenty-five Mile Creek	2	71	97	109	135

[1] Discharges Reflect Regulated Conditions

Table 1. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Mashel River					
Upstream of the Confluence with Little Mashel River	56	3,650	5,020	5,620	7,070
Little Mashel River					
At Mouth	24	1,450	1,940	2,140	2,630
Upstream of the Confluence with Midway Creek	15	1,010	1,370	1,520	1,890
Unnamed Creek					
At Silver Lake Outlet	2	31	39	42	51
Tanwax Creek					
Downstream of Mud Lake Outlet	14	270	375	425	535
Upstream of Mud Lake Outlet	9	196	271	306	384
At 352nd Street East (Golden Road)	6	143	197	222	278
At State Highway 161	4	128	177	198	248
South Creek					
At Cross Section A	29	312	436	488	618
At State Highway 7	24	274	381	428	541
Upstream of South Creek Tributary No. 2	14	188	260	292	367
South Creek Tributary No. 1					
At Mouth	6	109	150	168	210
At Cross Section AD	4	75	102	114	142
At Cross Section AP	1	26	35	38	48

Table 1. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
South Creek Tributary No. 2					
At Mouth	1	16	25	29	35
At Limit of Detailed Study	0.1	8	10	12	15
South Creek Tributary No. 3					
At State Highway 7	1	20	26	30	36
South Creek Tributary No. 4					
At Limit of Detailed Study	2	46	62	70	86
Muck Creek					
At State Highway 7	8	110	151	170	212
At Cross Section Y	5	76	104	117	145
Lacamas Creek					
At Confluence with Muck Lake	16	177	245	276	346
At Cross Section AJ	13	153	212	238	298
Downstream of 16th Avenue South (Schudy Road South)	4	73	100	112	139
At Hart's Lake Loop Road	2	32	43	48	59
Puyallup River					
At Confluence with White River[1]	934	36,000	45,000	45,000	49,000
At Confluence with Carbon River	416	24,400	33,200	36,800	45,900
Upstream of Confluence with Carbon River	186	11,700	16,400	18,400	23,400
Upstream of Confluence with Kapowsin Creek	138	9,860	14,200	16,000	20,800

[1] Discharges Reflect Regulated Conditions

Table 1. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs) 10-Year	50-Year	100-Year	500-Year
Swan Creek					
At Mouth	3	172	222	244	293
Squally Creek					
At Mouth	1	23	31	34	43
Clear Creek					
At Cross Section A	7	98	134	151	188
At Pioneer Way	2	52	70	79	98
Wapato Creek I					
At Mouth	5	115	157	177	221
At Cross Section AJ (Private Road)	4	89	122	138	171
Wapato Creek II					
At the Diversion Culvert to the Puyallup River	2	43	59	66	81
Hylebos Creek					
At Mouth	19	244	339	381	480
White River					
At Mouth	494	16,400	18,300	19,100	21,600
At State Highway 410 in the City of Buckley	427	13,800	14,800	15,500	17,200
At Confluence with Greenwater River	294	18,600	25,800	28,900	36,700

[1] Discharges Reflect Regulated Conditions

Table 1. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
White River (Cont'd)					
Upstream of Confluence with Greenwater River	217	13,500	18,700	20,900	26,400
Upstream of Confluence with West Fork White River	145	8,940	12,200	13,600	17,000
Salmon Creek					
At State Highway 167	1.2	37	50	57	70
At Cross Section H (Private Road)	0.6	24	33	37	45
Carbon River					
At Mouth	230	13,100	17,600	19,500	24,200
Upstream of Confluence with Voight Creek	191	11,300	15,300	17,000	21,200
Upstream of Confluence with South Prairie Creek	97	6,650	9,350	10,500	13,500
South Prairie Creek					
At Mouth	91	5,030	6,640	7,330	8,950
Greenwater River					
At Mouth	76	5,620	8,080	9,180	11,900
Wilkeson Creek					
At State Highway 165 Bridge in Center of Wilkeson	24	1,400	1,830	2,010	2,430
Fennel Creek					
At State Highway 410	7	154	213	240	300

Table 1. Summary of Discharges (Cont'd)

Flooding Source and Location	Drainage Area (Square Miles)	Peak Discharges (cfs)			
		10-Year	50-Year	100-Year	500-Year
Debra Jane Creek					
At Mouth	1.3	45	62	69	85
At Confluence with Bonney Lake Outflow	0.8	26	34	38	48
At Upstream End of Debra Jane Lake	0.1	9	12	14	17
Bonney Lake Outflow					
At Mouth	0.5	16	22	24	30
Muck Creek (At Roy)					
Downstream From Burlington Northern Railroad Bridge in the Town of Roy (At U.S. Geological Survey Stream Gage No. 12090200)	86.8	610	850	960	1220

Wave runup was determined by comparing the high-water-mark elevations of the December 1977 storm against the recorded high-tide levels as transferred from Seattle.

Elevations for floods of the selected recurrence intervals on the 13 lakes and the Puget Sound studied by detailed methods are shown in Table 2.

3.2 Hydraulic Analyses

Analyses of the hydraulic characteristics of flooding from the sources studied were carried out to provide estimates of the elevations of floods of the selected recurrence intervals.

Water-surface elevations for floods of the selected recurrence intervals were computed through use of the COE HEC-2 step-backwater computer program (Reference 22) for the Puyallup and Carbon Rivers. Water-surface elevations for all remaining detailed-study streams were computed through use of a combination of the USGS step-backwater computer program (Reference 23), culvert rating analyses (Reference 24), and computations of flow over roads (Reference 25).

Cross sections used in the backwater analyses of the Puyallup and Carbon Rivers were developed by the COE. The above-water sections were developed using aerial photographs taken in May 1980 at a scale of 1:4,800 (Reference 26).

For the remaining detailed-study streams, cross section data for the backwater analyses were obtained by photogrammetry from aerial photographs taken in April 1976 at a scale of 1:4,800 and 1:9,600 (References 27, 28, and 29) and in February 1974 at a scale of 1:4,800 (Reference 28), supplemented by field measurements used to develop the below-water sections. Elevation data and structural geometry for bridges, culverts, road overflow sections, and a few additional channel cross sections were obtained by field survey.

Locations of selected cross sections used in the hydraulic analyses are shown on the Flood Profiles (Exhibit 1). For stream segments for which a floodway was computed (Section 4.2), selected cross section locations are also shown on the Flood Boundary and Floodway Map (Exhibit 2).

Roughness factors (Manning's "n") used in the hydraulic computations for the Puyallup and Carbon Rivers were obtained by calibrating the HEC-2 model at selected cross sections based on high-water marks for the December 1977 flood. Roughness values for the Puyallup River were 0.022 for the main channel and 0.037 for the overbank areas. For the Carbon River, the roughness values ranged from 0.030 to 0.045 for the main channel and from 0.050 to 0.060 for the overbank areas.

Table 2. Summary of Elevations

Flooding Source and Location	Elevation (Feet)			
	10-Year	50-Year	100-Year	500-Year
Kreger Lake	531.1	531.4	531.5	531.6
Silver Lake	607.0	607.2	607.3	607.5
Rapjohn Lake	635.9	636.1	636.2	636.4
American Lake	235.1	235.6	235.7	236.2
Gravelly Lake	219.7	219.9	219.9	220.1
Spanaway Lake	323.4	323.8	324.0	324.3
Ohop Lake	524.4	525.1	525.4	526.2
Tanwax Lake	602.0	602.3	602.4	602.6
Lake Louise	225.9	226.1	226.2	226.3
Lake Kapowsin	583.3	583.9	584.1	584.6
Steilacoom Lake	208.9	209.8	210.2	211.2
Harts Lake	348.2	348.5	348.6	348.8
Little Lake	348.2	348.5	348.6	348.8
Puget Sound				
At Commencement Bay	8.4	8.8	8.9	9.2
At Day Island	8.7	9.1	9.2	9.5
At Nisqually Reach	9.4	9.8	9.9	10.2

Channel roughness factors (Manning's "n") used in the hydraulic computations for the remaining detailed-study streams were chosen by engineering judgment and based on field observations of the streams and flood plain areas. Main channel roughness values ranged from 0.025 to 0.080; roughness values for the flood plain ranged from 0.032 to 0.150 for all floods.

Mean higher-high tide elevations at the mouth were used as starting water-surface elevations for the Nisqually and Puyallup Rivers, Wapato Creek I, and Hylebos Creek.

For Spanaway, Muck, and Lacamas Creeks, starting water-surface elevations were determined from culvert rating curves using approach sections. The design elevation at the upstream opening of the diversion culvert was used as the starting water-surface elevation for Wapato Creek II.

Starting water-surface elevations for Clover and Unnamed Creeks, and the Carbon River were calculated using the slope-area method.

Starting water-surface elevations were determined by profile convergence from downstream cross sections for the Mashel River; Chambers, Tanwax, and South Creeks; the upstream reaches of the White River; Wilkeson, Fennel, and Debra Jane Creeks; and Bonney Lake Outflow.

For the remaining streams, the 100-year flood elevations were assumed to coincide with those on the main stems; therefore, the water-surface elevations in the mainstream channels were used for the starting water-surface elevations for the tributaries.

The water-surface elevation computer for Muck Creek (at Roy) for a 10-year flood at the locatiion of streamflow gaging station No. 12090200 was verified by the stage-discharge relationship in use when the gage was discontinued in 1976. As that relationship extends only to approximately a 17-year flood, the highest recorded peak at the gage, it could not be used to verity the water-surface elevations computed for the 50-, 100-, and 500-year floods.

The hydraulic analyses for this study were based on unobstructed flow. The flood elevations shown on the profiles are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

The acceptability of all assumed hydraulic factors, cross sections, and hydraulic structure data was verified by computations that duplicated the profiles of the February 1972 flood from the Nisqually River and the December 1977 flood from the Puyallup and White Rivers.

Generally, the distances on the flood profiles correspond to distances measured along the centerline of the designated watercourses. In several areas, however, the meandering nature of the low-flow streambeds necessitated use of distances measured along the centerline of the 100-year flow paths. On the maps, these flow lines, used to establish the respective profile distances, are delineated and labeled as Profile Base Lines.

The levees located along the Carbon River from the mouth upstream to State Highway 162 provide 3 feet of freeboard with respect to the 100-year flood; however, due to insufficient information regarding the levee's maintenance, they cannot be credited with providing 100-year flood protection. Therefore, water-surface elevations were computed for two cases. In the first case, flood elevations were computed assuming the levees remain intact. In the second case, the levees were assumed to have been removed.

Profiles labeled "Carbon River With Consideration of Levees" represent elevations inside the levees under the assumption that the levees do not fail.

Profiles labeled "Carbon River Without Consideration of Levees" represent overbank elevations that would occur if the levees did not exist.

Shallow flooding areas were determined by field investigations and interpretation of aerial photographs (Reference 26).

The 100-year flood elevations for creeks studied by approximate methods were established according to the professional judgment of engineers, taking into account flood elevations estimated from available data, existing hydrologic and hydraulic analyses, correlations with similar streams, and field observations.

All elevations are referenced to the National Geodetic Vertical Datum of 1929 (NGVD). Elevation reference marks used in this study are shown on the maps.

4.0 FLOOD PLAIN MANAGEMENT APPLICATIONS

The NFIP encourages State and local governments to adopt sound flood plain management programs. Therefore, each Flood Insurance Study produces maps designed to assist communities in developing flood plain management measures.

4.1 Flood Boundaries

To provide a national standard without regional discrimination, the 1 percent annual chance (100-year) flood has been adopted by FEMA as the base flood for flood plain management purposes.

The 0.2 percent annual chance (500-year) flood is employed to indicate additional areas of flood risk in the community. For each stream studied in detail, the 100- and 500-year flood plain boundaries have been delineated using the flood elevations determined at each cross section. Between cross sections, the boundaries were interpolated using topographic maps at a scale of 1:9,600, with contour intervals of 2 and 4 feet (Reference 30) and at a scale of 1:4,800, with a contour interval of 5 feet (Reference 31).

Detailed flood plain boundaries for tidal, lake, and shallow flooding areas were delineated using topographic maps as referenced above.

For streams studied by approximate methods, the boundary of the 100-year flood was delineated using topographic maps (Reference 32) and aerial photographs (Reference 27).

The 100- and 500-year flood plain boundaries are shown on the Flood Boundary and Floodway Map (Exhibit 2). In cases where the 100- and 500-year flood plain boundaries are close together, only the 100-year flood plain boundary has been shown. Small areas within the flood plain boundaries may lie above the flood elevations but cannot be shown due to limitations of the map scale and/or lack of detailed topographic data.

For the streams studied by approximate methods, only the 100-year flood plain boundary is shown.

Approximate 100-year flood plain boundaries in some portions of the study area were taken directly from the Flood Hazard Boundary Map (Reference 33).

Additional approproximate flood boundaries were provided by the Pierce County Public Works Department (Reference 34). These Pierce boundaries were derived from a variety of sources including soils and topographic maps, improvement and basin drainage plans, and aerial photographs.

4.2 Floodways

Encroachment on flood plains, such as structures and fill, reduces flood-carrying capacity, increases flood heights and velocities, and increases flood hazards in areas beyond the encroachment itself. One aspect of flood plain management involves balancing the economic gain from flood plain development against the resulting increase in flood hazard. For purposes of the NFIP, a floodway is used as a tool to assist local communities in this aspect of flood plain management. Under this concept, the area of the 100-year flood plain is divided into a floodway and a floodway fringe. The floodway is the channel of a stream, plus any adjacent flood plain areas, that must be kept free of encroachment so that the 100-year flood can be carried without substantial increases in flood heights. Minimum Federal standards limit such increases to 1.0 foot, provided that hazardous velocities are not produced. The floodways in this study are presented to local agencies as minimum standards that can be adopted directly or that can be used as a basis for additional floodway studies.

The 100- and 500-year floods on the Puyallup River from the City of Tacoma corporate limits to cross section AC near 15th Street NW are confined between levees that protect the adjacent old flood plain areas. The floodway for the Puyallup River in this area is thus defined as the area between these levees.

The floodways presented for the entire detailed reach of Spanaway and South Creeks and South Creek Tributary No. 4 and for portions of Salmon, Leach, South Prairie, Clover, Hylebos, and North Fork Clover Creeks, Muck Creek at Roy, South Creek Tributary No. 1, and Nisqually, Puyallup, White, and Carbon Rivers were computed on the basis of equal-conveyance reduction from each side of the flood plain. The results of these computations are tabulated at selected cross sections for each stream segment for which a floodway is computed (Table 3).

Hydraulic analysis for Wilkeson Creek, Fennel Creek, Debra Jane Creek, and Bonney Lake Outflow revealed that encroachment up to the channel banks will not increase the flood elevations more than 1.0 foot; therefore, the natural channel banks serve as the floodway.

Because the floodways on the above-mentioned streams are defined in this way, no floodway data or delineations are presented.

Floodways were not computed on Swan, Squally, and Clear Creeks downstream of the Burlington Northern Railroad because the flooding in these areas is a result of backwater from the Puyallup River.

Upstream of cross section D on the Carbon River, a floodway computation was not included in the scope of study.

The concept of a floodway is not applicable to lake, tidal, and shallow flooding areas.

Where the channel velocity is high (at or near critical) and/or the flow is confined to the high-water channel, the floodway is shown coincident with the 100-year boundary. This occurs on the following streams: the entire detailed reaches for the Mashel and Little Mashel Rivers, South Creek Tributary No. 2, Chambers and Squally Creeks, and Wapato Creeks I and II; and on portions of Leach, Clover, North Fork Clover, Horn, Unnamed, Lacamas, Swan, Clear, Hylebos, and Salmon Creeks, and South Creek Tributary No. 1.

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Spanaway Creek								
A	2,640	28	75	1.61	283.3	283.3	283.3	0.0
B	3,470	45	32	3.72	289.3	289.3	289.3	0.0
C	3,530	85	91	1.31	291.2	291.2	291.2	0.0
D	4,830	60	137	0.87	291.6	291.6	291.6	0.0
E	5,530	50	64	1.87	291.8	291.8	291.8	0.0
F	5,970	27	59	2.04	292.2	292.2	292.2	0.0
G	6,015	27	60	2.00	292.3	292.3	292.3	0.0
H	6,150	40	98	1.22	292.4	292.4	292.4	0.0
I	7,970	64	32	3.72	294.7	294.7	294.7	0.0
J	8,490	60	97	2.48	298.1	298.1	298.2	0.1
K	9,910	60	102	2.36	301.2	301.2	301.7	0.5
L	10,680	65	55	4.39	308.9	308.9	308.9	0.0
M	10,750	53	67	3.62	315.9	315.9	315.9	0.0
N	11,050	60	208	1.16	316.2	316.2	316.3	0.1
O	11,750	33	39	6.11	319.2	319.2	319.2	0.0

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SPANAWAY CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
North Fork Clover Creek								
A	1,000	40	120	1.68	304.5	304.5	304.5	0.0
B	1,710	191	90	2.24	305.6	305.6	305.6	0.0
C	2,280	34	92	2.20	307.4	307.4	307.7	0.3
D	2,330	44	108	1.87	307.5	307.5	307.7	0.2
E	2,980	40	76	2.65	308.6	308.6	308.6	0.0
F	3,580	40	68	2.96	309.6	309.6	309.6	0.0
G	3,660	43	77	2.61	309.8	309.8	309.8	0.0
H	4,000	32	53	3.81	310.5	310.5	310.5	0.0
I	4,080	50	127	1.59	312.9	312.9	312.9	0.0
J	4,540	40	96	2.10	313.1	313.1	313.1	0.0
K	5,000	27	42	4.81	314.0	314.0	314.1	0.1

[1] Feet Above Mouth of North Fork Clover Creek

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

NORTH FORK CLOVER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Nisqually River								
A	9,710	945/565^{2}	6,507	5.07	10.0	10.0	10.0	0.0
B	11,410	900/480^{2}	5,881	5.61	11.1	11.1	11.1	0.0
C	12,800	359/149^{2}	3,493	9.45	12.3	12.3	12.8	0.5
D	14,150	1500/790^{2}	8,269	3.99	14.9	14.9	15.8	0.9
E	15,710	1400/970^{2}	9,253	3.57	16.6	16.6	17.3	0.7
F	16,210	1700/ 1120^{2}	9,771	3.38	17.2	17.2	17.8	0.6
G	16,540	1500/930^{2}	7,779	4.24	17.7	17.7	18.3	0.6
H	17,810	600/250^{2}	5,697	5.79	19.6	19.6	20.1	0.5
I	18,170	589/439^{2}	4,399	7.50	20.2	20.2	20.7	0.5
J	19,100	600/350^{2}	4,638	7.12	22.4	22.4	22.5	0.1
K	20,100	423/123^{2}	3,594	9.18	24.4	24.4	25.1	0.7
L	20,770	614/134^{2}	6,771	4.87	28.2	28.2	28.4	0.2
M	24,480	950/550^{2}	8,932	3.69	31.7	31.7	31.9	0.2
N	25,660	800/70^{2}	6,362	5.19	32.6	32.6	32.9	0.3
O	26,730	1050/550^{2}	9,974	3.31	33.9	33.9	34.2	0.3
P	27,730	1500/ 1060^{2}	8,739	3.78	35.0	35.0	35.5	0.5
Q	29,280	1700^{3}	12,226	2.70	37.6	37.6	38.3	0.7
R	30,360	1700^{3}	8,839	3.73	39.3	39.3	40.0	0.7
S	31,810	1700^{3}	10,198	3.24	42.8	42.8	43.8	1.0
T	32,980	1600^{3}	11,122	2.97	44.8	44.8	45.6	0.8
U	34,000	1400^{3}	8,641	3.82	46.9	46.9	47.4	0.5
V	35,130	1500^{3}	10,412	3.17	49.1	49.1	49.5	0.4
W	36,190	1500^{3}	11,561	2.85	50.3	50.3	51.1	0.8
X	37,400	1500^{3}	11,563	2.85	51.9	51.9	52.7	0.8

[1] Feet Above Mouth [2] Width/Width Within Pierce County [3] Floodway Lies Entirely Outside Study Area

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

NISQUALLY RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Nisqually River (Cont'd)								
Y	38,720	1600[2]	10,446	3.16	53.7	53.7	54.5	0.8
Z	39,870	2060[2]	11,984	2.75	55.2	55.2	55.9	0.7
AA	40,920	2000[2]	8,546	3.86	57.6	57.6	58.1	0.5
AB	42,260	1400[2]	11,079	2.98	60.3	60.3	60.9	0.6
AC	43,580	1300[2]	6,035	5.47	62.5	62.5	63.2	0.7
AD	44,700	1300[2]	7,908	4.17	66.1	66.1	66.9	0.8
AE	46,650	1800[2]	13,936	2.37	70.2	70.2	71.1	0.9
AF	49,050	950[2]	4,322	7.64	75.6	75.6	76.0	0.4
AG	50,220	800[2]	6,355	5.19	80.1	80.1	80.8	0.7
AH	51,270	700[2]	4,667	7.07	83.3	83.3	83.8	0.5
AI	52,180	900[2]	5,729	5.76	87.9	87.9	88.1	0.2
AJ	55,200	900[2]	9,054	3.64	96.1	96.1	96.4	0.3
AK	57,270	650/320[3]	5,895	5.60	98.7	98.7	99.3	0.6
AL	58,350	400/110[3]	4,276	7.72	100.8	100.8	101.6	0.8
AM	59,310	400/160[3]	3,564	9.26	104.7	104.7	105.2	0.5
AN	59,690	400/170[3]	3,760	8.78	106.0	106.0	106.7	0.7
AO	60,550	400/130[3]	3,350	9.85	109.4	109.4	109.8	0.4
AP	61,650	350/180[3]	3,297	10.01	114.4	114.4	114.8	0.4
AQ	62,750	300/180[3]	3,165	10.43	119.0	119.0	119.2	0.2
AR	63,830	300/120[3]	3,778	8.74	123.4	123.4	123.4	0.0
AS	64,610	300/200[3]	3,566	9.25	125.5	125.5	125.6	0.1
AT	65,840	300/190[3]	4,572	7.22	128.2	128.2	128.3	0.1
AU	66,770	300/220[3]	5,266	6.27	129.6	129.6	129.9	0.3
AV	67,700	300/160[3]	3,874	8.52	130.9	130.9	131.4	0.5
AW	68,550	300/200[3]	3,455	9.55	132.8	132.8	133.1	0.3

[1] Feet Above Mouth [2] Floodway Lies Entirely Outside Study Area [3] Width/Width Within Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

NISQUALLY RIVER

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Nisqually River (Cont'd)								
AX	69,440	300/160	4,466	7.39	135.2	135.2	135.5	0.3
AY	70,560	300/230	3,648	9.05	137.7	137.7	137.9	0.2
AZ	71,840	350/100	4,278	7.71	141.5	141.5	141.9	0.4
BA	72,890	350/110	3,540	9.32	144.8	144.8	145.3	0.5
BB	73,860	350/170	3,832	8.61	149.2	149.2	149.9	0.7
BC	76,120	400/180	4,970	6.64	155.3	155.3	156.0	0.7
BD	77,190	350/150	3,787	8.71	157.6	157.6	158.3	0.7
BE	76,170	350/170	3,286	10.04	161.5	161.5	162.2	0.7
BF	79,310	350/210	3,448	9.57	167.4	167.4	167.5	0.1
BG	80,310	300/200	2,258	14.62	172.5	172.5	172.5	0.0
BH	81,260	328/188	2,858	11.55	182.4	182.4	182.4	0.0
BI	82,330	311/211	3,410	9.68	190.2	190.2	190.2	0.0
BJ	83,360	276/136	2,801	11.78	195.8	195.8	195.8	0.0
BK	84,360	335/205	3,967	8.32	200.9	200.9	200.9	0.0
BL	85,360	308/128	3,192	10.34	204.8	204.8	204.8	0.0
BM	86,250	332/192	3,008	10.97	209.9	209.9	209.9	0.0
BN	87,600	388/348	3,244	10.17	217.6	217.6	217.6	0.0
BO	88,690	400/300	4,360	7.57	222.1	222.1	222.1	0.0
BP	89,840	350/250	3,195	10.33	225.6	225.6	225.6	0.0
BQ	90,820	300/120	3,289	10.03	230.6	230.6	230.7	0.1
BR	91,750	217/137	2,850	11.58	234.8	234.8	234.8	0.0
BS	92,660	300/170	3,734	8.84	239.0	239.0	239.0	0.0
BT	93,780	300/110	3,835	8.61	241.9	241.9	242.1	0.2
BU	94,840	293/93	3,850	8.57	244.5	244.5	244.6	0.1
BV	95,700	300/180	4,919	6.71	246.8	246.8	246.9	0.1

[1] Feet Above Mouth [2] Width/Width Within Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

NISQUALLY RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH[2] (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Nisqually River (Cont'd)								
BW	96,740	305/175	4,321	7.64	248.2	248.2	248.3	0.1
BX	97,690	320/120	4,152	7.95	250.8	250.8	250.8	0.0
BY	98,660	320/150	4,392	7.51	253.3	253.3	253.4	0.1
BZ	99,130	280/210	3,180	10.38	254.4	254.4	254.4	0.0
CA	100,020	225/65	3,465	9.52	257.9	257.9	257.9	0.0
CB	101,120	350/180	4,806	6.87	260.9	260.9	261.0	0.1
CC	102,160	300/200	3,852	8.57	262.7	262.7	262.9	0.2
CD	103,260	263/73	3,484	9.47	265.7	265.7	265.8	0.1
CE	104,270	285/85	3,843	8.59	269.2	269.2	269.2	0.0
CF	105,260	318/128	3,989	8.27	272.0	272.0	272.0	0.0
CG	106,150	270/130	3,706	8.90	274.8	274.8	274.8	0.0
CH	106,910	267/177	3,268	10.10	277.2	277.2	277.2	0.0
CI	107,840	352/202	3,352	9.85	281.1	281.1	281.1	0.0
CJ	108,730	311/201	3,312	9.96	285.9	285.9	285.9	0.0
CK	109,750	550/310	5,003	6.60	290.6	290.6	290.7	0.1
CL	110,730	600/370	4,510	7.32	293.2	293.2	293.7	0.5
CM	111,360	650/440	5,283	6.25	295.0	295.0	295.5	0.5
CN	111,990	657/577	5,536	5.96	296.4	296.4	297.3	0.9
CO	112,670	600/450	4,564	7.23	298.7	298.7	299.1	0.4
CP	113,650	350/160	3,787	8.71	300.7	300.7	301.5	0.8
CQ	114,020	500/290	4,221	7.82	302.7	302.7	302.7	0.0
CR	114,990	500/120	4,045	8.16	304.4	304.4	305.1	0.7
CS	115,980	500/170	3,757	8.78	307.3	307.3	307.8	0.5
CT	116,750	500/200	4,285	7.70	309.8	309.8	310.0	0.2
CU	117,550	500/80	5,146	6.41	311.8	311.8	311.9	0.1

[1] Feet Above Mouth [2] Width/Width Within Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

NISQUALLY RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Nisqually River (Cont'd)								
CV	118,650	600/210[2]	6,024	5.48	313.1	313.1	313.5	0.4
CW	119,690	700/215[2]	6,828	4.83	314.3	314.3	314.8	0.5
CX	120,700	800/200[2]	6,964	4.74	315.0	315.0	316.0	1.0
CY	121,730	800/120[2]	5,869	5.62	316.4	316.4	317.4	1.0
CZ	122,880	800/265[2]	5,982	5.52	318.3	318.3	319.2	0.9
DA	123,930	600/265[2]	4,619	7.14	320.2	320.2	321.2	1.0
DB	124,940	500/225[2]	5,091	6.48	322.9	322.9	323.4	0.5
DC	125,950	500/330[2]	4,528	7.29	324.6	324.6	325.0	0.4
DD	126,890	500/350[2]	4,790	6.89	326.5	326.5	326.9	0.4
DE	127,870	500/240[2]	5,373	6.14	328.5	328.5	328.7	0.2
DF	128,930	500/290[2]	4,571	7.22	329.9	329.9	330.4	0.5
DG	129,930	500/160[2]	4,856	6.80	331.8	331.8	332.4	0.6
DH	130,870	500/110[2]	4,861	6.79	333.4	333.4	334.1	0.7
DI	131,740	600/150[2]	8,652	3.81	334.9	334.9	335.8	0.9
DJ	132,700	598/98[2]	7,498	4.40	335.7	335.7	336.6	0.9
DK	133,680	500/150[2]	5,611	5.88	337.0	337.0	337.6	0.6
DL	134,620	500/110[2]	4,682	7.05	338.7	338.7	339.2	0.5
DM	135,730	900	9,948	3.22	341.3	341.3	341.7	0.4

[1] Feet Above Mouth [2] Width/Width Within Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

NISQUALLY RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Creek								
A	32,890	80	250.	1.95	521.0	521.0	521.4	0.4
B	35,030	80	324	1.32	521.8	521.8	522.4	0.6
C	35,700	80	198	2.16	522.1	522.1	522.9	0.8
D	35,960	80	226	1.89	522.4	522.4	523.2	0.8
E	36,420	35	85	5.04	524.2	524.2	524.4	0.2
F	37,120	57	102	4.22	530.3	530.3	530.3	0.0
G	37,660	53	116	3.69	533.1	533.1	533.1	0.0
H	37,750	48	101	4.25	533.6	533.6	533.7	0.1
I	38,280	35	85	5.03	537.1	537.1	537.1	0.0
J	38,840	35	85	5.04	541.1	541.1	541.1	0.0
K	39,400	53	133	3.22	543.3	543.3	543.3	0.0
L	39,990	36	98	4.37	544.7	544.7	544.9	0.2
M	40,090	30	167	2.56	545.8	545.8	546.1	0.3
N	40,570	40	148	2.89	546.1	546.1	546.1	0.6
O	41,040	29	60	7.14	549.2	549.2	549.2	0.0
P	41,600	35	107	4.01	553.6	533.6	533.8	0.2
Q	41,950	30	104	4.10	554.6	554.6	554.8	0.2
R	42,020	30	115	3.71	555.0	555.0	555.1	0.1
S	42,710	30	63	6.82	559.3	559.3	559.3	0.0
T	43,210	40	105	4.09	564.1	564.1	564.1	0.0
U	43,810	40	78	5.51	568.1	568.1	568.3	0.2
V	44,350	40	121	3.53	570.8	570.8	571.6	0.8
W	44,920	40	130	3.29	572.4	572.4	573.0	0.6
X	45,530	40	117	3.66	574.3	574.3	574.5	0.2
Y	46,040	38	60	7.09	579.4	579.4	579.4	0.0
Z	46,550	60	112	3.82	585.8	585.8	585.9	0.1

[1] Feet Above Mouth

TABLE 3	FEDERAL EMERGENCY MANAGEMENT AGENCY PIERCE COUNTY, WA (UNINCORPORATED AREAS)	FLOODWAY DATA SOUTH CREEK

37

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
South Creek (Cont'd)								
AA	47,180	60	105.	4.08	588.8	588.8	589.0	0.2
AB	47,740	60	166	2.58	590.5	590.5	590.9	0.4
AC	48,250	60	266	1.61	590.8	590.8	591.5	0.7
AD	48,760	60	226	1.89	591.0	591.0	591.8	0.8
AE	49,300	60	156	2.75	591.8	591.8	592.7	0.9
AF	49,940	60	108	3.96	595.9	595.9	595.9	0.0
AG	50,500	60	149	2.87	598.3	598.3	598.8	0.5
AH	50,560	60	116	3.70	598.4	598.4	599.1	0.7
AI	51,150	60	168	2.55	600.1	600.1	600.7	0.6
AJ	51,790	60	126	3.40	601.4	601.4	601.9	0.5
AK	52,540	60	163	2.62	603.0	603.0	603.7	0.7
AL	53,020	60	151	2.83	604.3	604.3	604.7	0.4
AM	53,640	60	154	2.03	605.7	605.7	606.2	0.5
AN	54,210	60	115	2.72	607.5	607.5	607.6	0.1
AO	54,720	60	112	2.79	609.1	609.1	609.3	0.2
AP	55,360	40	108	2.70	610.8	610.8	611.3	0.5
AQ	55,730	50	95	3.07	612.4	612.4	612.6	0.2
AR	55,780	45	66	4.42	612.8	612.8	612.9	0.1
AS	56,190	60	116	2.52	615.1	615.1	615.1	0.0
AT	56,710	60	82	3.54	617.3	617.3	617.3	0.0
AU	57,300	60	130	2.25	619.2	619.2	619.2	0.3
AV	57,860	60	114	2.55	620.0	620.0	620.5	0.5
AW	58,410	60	150	1.94	620.8	620.8	621.2	0.4
AX	58,960	60	190	1.54	621.2	621.2	621.7	0.5
AY	59,500	60	123	2.38	622.0	622.0	622.3	0.3
AZ	60,080	40	127	2.29	623.3	623.3	623.3	0.0

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Creek (Cont'd)								
BA	60,150	60	164	1.79	623.5	623.5	623.5	0.0
BB	60,780	60	172	1.69	623.7	623.7	623.9	0.2
BC	61,360	60	139	2.10	623.9	623.9	624.4	0.5
BD	61,970	60	178	1.64	624.3	624.3	625.1	0.8
BE	62,600	60	182	1.48	624.8	624.8	625.6	0.8
BF	63,230	60	132	2.04	625.5	625.5	626.3	0.8
BG	63,750	40	93	2.91	626.8	626.8	627.4	0.6
BH	64,320	40	120	2.25	628.0	628.0	628.5	0.5
BI	64,380	45	182	1.48	631.4	631.4	631.4	0.0
BJ	64,870	40	192	1.41	631.4	631.4	631.5	0.1
BK	65,460	40	180	1.50	631.4	631.4	631.7	0.3
BL	65,950	40	139	1.95	631.4	631.4	631.8	0.4
BM	66,440	40	155	1.75	631.4	631.4	632.1	0.7
BN	66,830	39	116	2.33	631.5	631.5	632.3	0.8

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY (FEET NGVD)	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
South Creek Tributary No.1								
A	570	23	60	2.78	605.6	605.6	605.6	0.0
B	1,170	24	58	2.89	607.1	607.1	607.1	0.0
C	1,730	32	77	2.19	608.3	608.3	608.3	0.0
D	2,330	23	67	2.50	609.3	609.3	609.3	0.0
E	2,900	31	80	2.09	610.1	610.1	601.1	0.0
F	3,530	16	60	2.79	611.1	611.1	611.1	0.0
G	3,650	32	89	1.89	611.3	611.3	611.3	0.0
H	4,270	29	78	2.15	611.9	611.9	611.9	0.0
I	4,880	20	62	2.72	612.8	612.8	612.8	0.0
J	5,510	18	49	2.59	614.1	614.1	614.1	0.0
K	6,130	22	75	1.70	615.0	615.0	615.0	0.0
L	6,740	25	84	1.51	615.4	615.4	615.4	0.0
M	7,340	24	82	1.56	615.7	615.7	615.7	0.0
N	7,460	19	53	2.42	615.8	615.8	615.8	0.0
O	7,910	23	59	2.16	616.7	616.7	616.7	0.0
P	7,940	23	57	2.26	616.7	616.7	616.7	0.0
Q	8,550	20	63	2.04	617.6	617.6	617.6	0.0
R	9,070	25	92	1.39	617.9	617.9	618.0	0.1
S	9,650	25	115	1.12	617.9	617.9	618.2	0.3
T	10,210	30	111	1.15	617.9	617.9	618.3	0.4
U	11,110	30	113	1.13	618.0	618.0	618.6	0.6
V	11,640	40	178	0.72	618.0	618.0	618.7	0.7
W	12,210	40	174	0.74	618.0	618.0	618.7	0.7
X	12,790	40	142	0.90	618.0	618.0	618.8	0.8
Y	13,170	40	123	1.04	618.0	618.0	618.9	0.9
Z	13,270	28	100	1.29	618.0	618.0	618.9	0.9

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH CREEK TRIBUTARY NO. 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
South Creek Tributary No. 1 (Cont'd)								
AA	13,630	24	94	1.36	618.3	618.3	619.1	0.8
AB	13,710	28	105	1.22	619.1	619.1	619.1	0.0
AC	14,250	30	70	1.83	619.2	619.2	619.4	0.9
AD	14,860	40	149	0.76	619.3	619.3	619.7	0.4
AE	15,440	40	122	0.94	619.3	619.3	619.8	0.5
AF	15,970	40	117	0.97	619.3	619.3	619.9	0.6
AG	16,620	40	92	1.24	619.3	619.3	620.1	0.8
AH	17,120	40	92	0.93	619.5	619.5	620.3	0.8
AI	17,760	13	11	5.24	623.7	623.7	623.7	0.0
AJ	18,240	65	33	1.75	629.8	629.8	629.8	0.0
AK	18,630	18	13	4.31	633.9	633.9	633.9	0.0
AL	18,730	30	81	0.70	639.2	639.2	639.2	0.0
AM	19,660	20	13	4.51	651.2	651.2	651.2	0.0
ANN	20,300	20	36	1.59	656.7	656.7	656.8	0.1
AO	20,870	14	15	2.51	658.3	658.3	658.3	0.0
AP	21,500	15	21	1.80	660.6	660.6	660.7	0.1
AQ	22,150	10	6	4.76	666.0	666.0	666.0	0.0

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH CREEK TRIBUTARY NO. 1

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Creek Tributary No. 4								
A	500	30	57	1.22	521.1	521.1	521.2	0.1
B	1,060	30	46	1.52	521.2	521.2	521.7	0.5
C	1,130	21	52	1.34	521.4	521.4	521.4	0.0
D	1,630	30	53	1.31	521.6	521.6	521.6	0.0
E	2,200	30	68	1.03	521.6	521.6	521.8	0.2
F	2,780	30	80	0.87	521.6	521.6	522.0	0.4
G	3,350	30	77	0.91	521.6	521.6	522.1	0.5
H	3,910	30	76	0.92	521.6	521.6	522.3	0.7
I	4,490	30	71	0.99	521.6	521.6	522.4	0.8

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH CREEK TRIBUTARY NO. 4

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Puyallup River								
A	12,960	318[2,3]	4,613	9.8	11.8	11.8	11.8	0.0
B	13,900	294[2,3]	4,492	10.0	12.8	12.8	12.8	0.0
C	14,740	303[2,3]	4,706	9.6	13.7	13.7	13.7	0.0
D	15,260	318[2]	4,708	9.6	14.1	14.1	14.1	0.0
E	16,040	298[2]	4,417	10.2	14.6	14.6	14.6	0.0
F	16,980	311[2]	4,782	9.4	15.6	15.6	15.6	0.0
G	17,960	318[2]	4,765	9.4	16.3	16.3	16.3	0.0
H	18,910	323[2]	4,988	9.0	17.1	17.1	17.1	0.0
I	19,880	308[2]	4.616	9.8	17.8	17.8	17.8	0.0
J	20,760	315[2]	5,008	9.0	18.8	18.8	18.8	0.0
K	21,700	294[2]	5,065	8.9	19.5	19.5	19.5	0.0
L	22,710	342[2]	5,753	7.8	20.5	20.5	20.5	0.0
M	23,650	370[2]	6,077	7.4	21.0	21.0	21.0	0.0
N	24,590	329[2]	5,520	8.2	21.4	21.4	21.4	0.0
O	25,490	323[2]	5,233	8.6	21.9	21.9	21.9	0.0
P	26,490	371[2]	6,166	7.3	22.8	22.8	22.8	0.0
Q	27,480	435[2]	7,082	6.4	23.4	23.4	23.4	0.0
R	28,430	390[2]	6,055	7.4	23.8	23.8	23.8	0.0
S	29,340	345[2]	5,679	7.9	24.3	24.3	24.3	0.0
T	30,300	292[2]	4,896	9.2	24.8	24.8	124.8	0.0
U	30,630	308[2]	4,983	9.0	25.1	25.1	25.1	0.0
V	31,620	315[2]	4,906	9.2	25.9	25.9	25.9	0.0
W	32,710	288[2]	4,754	9.5	26.7	26.7	26.7	0.0
X	33,680	287[2]	4,813	9.4	27.5	27.5	27.5	0.0

[1] Feet Above Mouth

[2] Floodway is Contained Within Levees

[3] Floodway Lies Partially Within Area Not Included

TABLE 3	FEDERAL EMERGENCY MANAGEMENT AGENCY PIERCE COUNTY, WA (UNINCORPORATED AREAS)	FLOODWAY DATA PUYALLUP RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Puyallup River								
Y	34,640	278[2]	4,729	9.5	28.2	28.2	28.2	0.0
Z	35,460	330[2]	5,768	7.8	29.2	29.2	29.2	0.0
AA	36,340	364[2]	6,186	7.3	29.8	29.8	29.8	0.0
AB	37,250	307[2]	5,258	8.6	30.1	30.1	30.1	0.0

[1] Feet Above Mouth

[2] Width/Width Within Unincorporated Areas of Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

PUYALLUP RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Puyallup River								
AC	38,100	362/347[2]	5,938	7.6	30.9	30.9	30.9	0.0
AD[3]	39,150	293	5,235	8.6	31.6	31.6	31.6	0.0
AE[3]	40,090	280	4,789	9.4	31.9	31.9	32.0	0.1
AF[3]	40,930	371	6,202	7.3	33.0	33.0	33.2	0.2
AG[3]	42,030	382	5,996	7.5	33.7	33.7	33.9	0.2
AH[3]	43,010	366	5,603	8.0	34.3	34.3	34.5	0.2
AI[3]	43,370	351	5,270	8.5	34.5	34.5	34.6	0.1
AJ	44,330	283	4,985	9.0	35.6	35.6	35.6	0.0
AK	45,270	283/242[2]	5,309	8.5	36.4	36.4	36.7	0.3
AL	45,600	329/239[2]	5,436	8.3	36.7	36.7	37.0	0.3
AM	46,550	270/225[2]	5,054	8.9	37.9	37.9	37.9	0.0
AN	47,570	364/355[2]	7,191	6.3	38.8	38.8	39.4	0.6
AO	47,960	339/290[2]	6,595	6.8	39.1	39.1	39.5	0.4
AP	48,335	384/340[2]	5,148	8.7	39.1	39.1	39.5	0.4
AQ	50,005	452	6,715	6.7	41.8	41.8	42.2	0.4
AR	52,015	587/349[2]	7,579	5.9	43.5	43.5	44.3	0.8
AS	54,425	649/549[2]	9,115	4.9	45.7	45.7	46.4	0.7
AT	54,975	817/712[2]	9,425	4.8	46.2	46.2	46.9	0.7
AU	56,505	378/285[2]	4,228	8.7	47.7	47.7	48.2	0.5
AV	56,725	295/240[2]	4,140	8.9	48.0	48.0	48.8	0.8
AW	57,145	497/222[2]	5,152	7.1	49.7	49.7	50.1	0.4
AX	58,395	433[4]	4,559	8.1	51.6	51.6	52.1	0.5
AY	59,655	475/430[2]	4,464	8.2	54.0	54.0	54.5	0.5
AZ	60,795	404/315[2]	4,642	7.9	55.9	55.9	56.8	0.9
BA	61,770	315/245[2]	4,429	8.3	57.4	57.4	58.4	1.0
BB	62,590	318/258[2]	4,576	8.0	58.7	58.7	59.5	0.8

[1] Feet Above Mouth [2] Width/Width Within Unincorporated Areas of Pierce County

[3] Cross Section Located Entirely Within City of Puyallup [4] Floodway Lies Entirely Within Area Not Included

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

PUYALLUP RIVER

45

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY	INCREASE
Puyallup River (Cont'd)								
BC	63,780	206/179[2]	3,300	11.2	60.2	60.2	60.7	0.5
BD	65,970	500	4,005	9.2	66.0	66.0	66.2	0.2
BE	66,790	515	3,779	9.7	67.7	67.7	68.1	0.4
BF	69,378	1,262	9,318	3.9	72.8	72.8	73.8	1.0
BG	70,418	668	6,660	5.5	74.3	74.3	75.0	0.7
BH	71,078	500	4,523	8.1	75.1	75.1	75.9	0.8
BI	71,708	625	4,911	7.5	76.4	76.4	77.3	0.9
BJ	72,578	912	5,437	6.8	78.6	78.6	79.0	0.4
BK	74,198	1,000	6,180	6.0	81.1	81.1	81.3	0.2
BL	76,169	850	5,659	6.5	84.3	84.3	84.6	0.3
BM	77,559	450	4,606	8.0	86.7	86.7	87.3	0.6
BN	79,249	360	3,991	9.2	90.0	90.0	90.6	0.6
BO	80,519	283	3,987	9.2	92.7	92.7	93.2	0.5
BP	82,159	431	4,007	9.2	96.5	96.5	96.7	0.2
BQ	83,379	784	5,085	7.2	98.9	98.9	99.6	0.7
BR	85,179	330	4,381	8.4	101.5	101.5	102.4	0.9
BS	86,419	819	5,629	6.5	103.6	103.6	104.3	0.7
BT	88,169	404	4,275	8.6	106.6	106.6	107.4	0.8
BU	89,529	361	3,432	10.7	110.2	110.2	110.3	0.1
BV	90,519	810	6,257	5.9	113.2	113.2	113.4	0.2
BW	92,239	662	3,617	10.2	116.1	116.1	116.5	0.4
BX	93,099	325	3,324	11.1	119.2	119.2	119.9	0.7
BY	95,986	490	3,781	4.9	127.4	127.4	127.6	0.2
BZ	97,556	167	1,537	12.0	128.1	128.1	128.9	0.8
CA	98,416	393	2,057	8.9	131.7	131.7	131.7	0.0

[1] Feet Above Mouth [2] Width/Width Within Unincorporated Areas of Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

PUYALLUP RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Puyallup River (Cont'd)								
CB	100,156	269	1,930	9.5	135.2	135.2	135.8	0.6
CC	101,116	452	2,701	6.8	139.3	139.3	139.4	0.1
CD	103,166	490	2,476	7.4	143.8	143.8	144.2	0.4
CE	104,946	666	2,742	6.7	148.6	148.6	149.4	0.8
CF	107,066	641	2,425	7.6	156.1	156.1	156.4	0.3
CG	108,336	646	1,918	9.6	161.8	161.8	162.7	0.9
CH	110,346	717	2,239	8.2	169.5	169.5	170.3	0.8
CI	111,286	467	1,841	10.0	174.6	174.6	174.7	0.1
CJ	112,336	618	2,125	8.7	179.4	179.4	179.7	0.3
CK	112,876	555	1,968	9.3	182.0	182.0	182.1	0.1
CL	114,206	565	1,982	9.3	190.3	190.3	190.3	0.0
CM	114,746	421	1,558	11.8	193.7	193.7	193.7	0.0
CN	119,849	365[2]	1,571	11.7	223.1	223.1	223.3	0.2
CO	121,019	458[2]	1,716	10.7	231.3	231.3	231.6	0.3
CP	121,719	383/283[3]	1,614	11.4	237.0	237.0	237.0	0.0
CQ	122,389	414	1,664	11.1	241.2	241.2	241.2	0.0
CR	123,419	674	1,927	9.5	249.0	249.0	249.0	0.0
CS	124,539	560	1,774	10.4	257.6	257.6	258.2	0.6
CT	125,219	377	1,597	11.5	263.6	263.6	263.8	0.2
CU	126,109	471	1,855	9.9	269.6	269.6	270.4	0.8
CV	126,889	595	2,034	9.0	276.4	276.4	276.4	0.0
CW	127,489	732	2,261	8.1	282.8	282.8	282.8	0.0
CX	128,579	721	1,801	10.2	290.8	290.8	290.8	0.0

[1] Feet Above Mouth

[2] Floodway Lies Entirely Within Area Not Included

[3] Width/Width Within Unincorporated Areas of Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

PUYALLUP RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Puyallup River (Cont'd)								
CY	129,139	435	1,730	10.6	295.9	295.9	295.9	0.0
CZ	129,839	416	1,763	10.4	302.1	302.1	302.1	0.0
DA	130,799	375	1,630	11.3	309.1	309.1	309.1	0.0
DB	131,689	258	1,388	13.3	318.1	318.1	318.1	0.0
DC	132,369	253	1,378	13.3	322.3	322.3	322.4	0.1
DD	133,099	314	1,546	11.9	329.1	329.1	329.1	0.0
DE	134,359	398	1,602	11.5	341.6	341.6	341.6	0.0
DF	134,809	479	1,774	10.4	345.9	345.9	346.2	0.3
DG	135,389	228	1,328	13.9	352.9	352.9	352.9	0.0
DH	136,189	142	1,139	16.2	361.1	361.1	361.1	0.0
DI	136,529	181	1,670	11.0	365.6	365.6	365.6	0.0
DJ	137,589	305	2,892	6.4	377.3	377.3	377.3	0.0
DK	138,469	678	1,954	9.4	383.1	383.1	383.1	0.0
DL	139,459	270	1,594	11.5	391.8	391.8	392.4	0.6
DM	140,469	589	1,648	11.2	403.4	403.4	403.9	0.5
DN	141,459	299	1,584	10.1	414.0	414.0	414.5	0.5
DO	142,449	336	1,491	10.7	422.4	422.4	423.2	0.8
DP	143,349	321	1,477	10.8	432.5	432.5	433.1	0.6
DQ	144,369	289	1,302	12.3	445.1	445.1	445.8	0.7
DR	145,389	359	1,600	10.0	457.6	457.6	458.1	0.5
DS	146,369	330	1,381	11.6	469.0	469.0	469.0	0.0
DT	148,439	215	1,304	12.1	493.6	493.6	494.3	0.7
DU	149,499	346	1,602	10.0	505.1	505.1	506.0	0.9
DV	150,609	1,021	2,338	6.8	519.2	519.2	519.6	0.4
DW	151,589	894	2,287	7.0	531.5	531.5	531.9	0.4

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

PUYALLUP RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Puyallup River (Cont'd)								
DX	152,659	699	2,235	7.2	542.9	542.9	543.3	0.4
DY	153,559	904	1,765	9.1	552.8	552.8	552.9	0.1
DZ	154,439	219	1,234	13.0	562.2	562.2	562.2	0.0
EA	154,709	857	3,544	4.5	565.6	565.6	565.6	0.0
EB	155,509	867	1,772	9.0	573.8	573.8	573.8	0.0
EC	156,489	816	1,890	8.5	588.3	588.3	588.3	0.0
ED	157,459	525	1,581	10.1	602.4	602.4	602.4	0.0
EE	158,329	565	1,929	8.3	613.0	613.0	613.0	0.0
EF	157,969	311	1,352	11.8	619.4	619.4	619.4	0.0
EG	159,789	422	1,639	9.8	629.7	629.7	629.7	0.0

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

PUYALLUP RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Hylebos Creek								
A	1,510	54	390	0.98	8.9	5.4^2	5.4^2	0.0
B	2,030	83	460	0.83	8.9	5.4^2	5.4^2	0.0
C	2,150	83	462	0.83	8.9	5.4^2	5.4^2	0.0
D	2,820	45	261	1.46	8.9	$5,5^2$	5.5^2	0.0
E	3,500	42	170	2.25	8.9	5.6^2	5.6^2	0.0
F	3,790	50	169	2.26	8.9	5.8^2	5.8^2	0.0
G	3,835	50	171	2.22	8.9	5.8^2	5.8^2	0.0
H	4,100	31	94	4.05	8.9	6.1^2	6.1^2	0.0
I	4,140	32	98	3.87	8.9	6.2^2	6.2^2	0.0

[1] Feet Above Mouth

[2] Elevation Computed Without Consideration of Backwater From Puget Sound (at Commencement Bay)

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

HYLEBOS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Hylebos Creek (Continued)								
J	4,810	30	135	2.81	8.9	8.9	9.1	0.2
K	5,290	25	117	3.26	9.2	9.2	9.7	0.5
L	5,760	44	265	1.44	9.6	9.6	10.2	0.6
M	5,890	45	236	1.61	10.1	10.1	10.3	0.2
N	6,130	44	177	2.15	10.2	10.2	10.4	0.2
O	6,260	40	207	1.84	10.7	10.7	11.0	0.3
P	6,780	33	155	2.45	10.9	10.9	11.1	0.2
Q	7,270	31	154	2.33	11.3	11.3	11.5	0.2
R	7,660	52	248	1.44	11.6	11.6	11.8	0.2
S	7,750	53	252	1.42	12.0	12.0	12.2	0.2
T	8,580	45	184	1.95	12.2	12.2	12.5	0.3
U	8,630	39	209	1.71	12.4	12.4	12.6	0.2
V	9,270	46	233	1.33	12.6	12.6	12.9	0.3
W	9,390	37	170	1.83	12.6	12.6	12.9	0.3
X	9,750	31	144	2.15	12.9	12.9	13.2	0.3
Y	9,830	35	214	1.45	13.3	13.3	13.3	0.0
Z	10,010	41	202	1.54	13.3	13.3	13.4	0.1
AA	10,540	33	196	1.58	13.4	13.4	13.6	0.2
AB	11,080	42	198	1.57	13.4	13.4	13.6	0.2
AC	11,310	34	200	1.55	13.5	13.5	13.8	0.3
AD	11,670	40	202	1.54	13.6	13.6	13.9	0.3
AE	12,290	24	104	2.98	13.6	13.6	14.2	0.6

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

HYLEBOS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
White River								
A	1,910	208	3,408	5.60	46.5	46.5	46.9	0.4
L	11,530	221[2]	3,499	5.46	51.7	51.7	51.9	0.2
M	12,530	191[2]	3,358	5.69	51.9	51.9	52.3	0.4
N	13,680	200/120[3]	3,858	4.95	52.4	52.4	53.0	0.6
O	14,680	200/130[3]	3,873	4.93	52.7	52.7	53.3	0.6
P	15,750	200/110[3]	3,548	5.19	53.2	53.2	53.7	0.5
Q	16,860	228/105[3]	3,496	5.26	53.7	53.7	54.2	0.5
R	17,960	230	3,318	5.55	54.3	54.3	54.7	0.4
S	19,230	300	3,670	5.01	55.0	55.0	55.4	0.4
T	20,370	300	2,640	6.97	55.5	55.5	56.1	0.6
U	21,340	250	3,056	6.02	56.4	56.4	57.4	1.0
V	23,670	250	2,144	8.58	60.3	60.3	60.9	0.6
W	24,890	200	2,433	7.56	62.8	62.8	63.4	0.6
X	25,970	243	2,098	8.77	64.5	64.5	64.9	0.4
Y	26,260	300	3,078	5.98	65.8	65.8	66.0	0.2
Z	27,480	300	2,258	8.15	67.1	67.1	67.4	0.3

[1] Feet Above Mouth

[2] Floodway Lies Entirely Within Area Not Included

[3] Width/Width Within Unincorporated Areas of Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

WHITE RIVER

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
White River (Cont'd)								
AA	28,550	300	1,876	9.81	70.0	70.0	70.2	0.2
AB	130,890	457/275[2]	2,290	6.77	690.1	690.1	690.6	0.5
AC	131,950	296/65[2]	1,590	9.75	695.5	695.5	696.4	0.9
AD	132,690	292/140[2]	1,691	9.16	701.1	701.1	701.1	0.0
Salmon Creek								
M	5,860	29	141	0.26	60.0	60.0	60.0	0.0
N	5,900	18	53	0.70	60.0	60.0	60.0	0.0
O	6,560	24	24	1.52	60.4	60.4	60.5	0.1
P	6,594	12	18	1.45	60.4	60.4	60.6	0.2
Q	6,660	12	19	1.35	60.6	60.6	60.7	0.1
R	6,686	8	15	1.68	60.6	60.6	60.7	0.1
S	6,870	10	18	1.41	61.0	61.0	61.1	0.1
T	6,896	10	23	1.15	61.0	61.0	61.1	0.1
U	7,590	10	38	0.69	61.1	61.1	61.4	0.3
V	8,520	10	20	1.27	61.2	61.2	61.8	0.6

[1] Feet Above Mouth [2] Width/Width Within Pierce County

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

WHITE RIVER-SALMON CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Carbon River (With Consideration of Levee)								
A	1,385	--[2]	--[2]	--[2]	125.4	--[2]	--[2]	--[2]
B	2,095	--[2]	--[2]	--[2]	127.9	--[2]	--[2]	--[2]
C	4,885	--[2]	--[2]	--[2]	140.5	--[2]	--[2]	--[2]
D	6,065	--[2]	--[2]	--[2]	145.1	--[2]	--[2]	--[2]
Carbon River (Without Consideration of Levee)								
A	1,385	447	3,370	5.8	124.9	124.9	125.4	0.5
B	2,095	375	2,661	7.3	127.2	127.2	127.8	0.6
C	4,885	433	2,891	6.7	139.1	139.1	139.7	0.6
D	6,065	499	3,429	5.7	143.9	143.9	144.2	0.3

[1] Feet Above Mouth

[2] Floodway Computed For Without Consideration of Levee Condition Only

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CARBON RIVER (WITH CONSIDERATION OF LEVEE)-
CARBON RIVER (WITHOUT CONSIDERATION OF LEVEE)

TABLE 3

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
South Prairie Creek								
R	17,110	595	978	7.16	346.7	346.7	346.7	0.0
S	17,850	274	1,244	5.63	351.6	351.6	351.6	0.0
T	18,060	154	858	8.16	352.1	352.1	352.2	0.1
U	18,780	113	963	7.27	355.3	355.3	355.4	0.1
V	19,460	103	887	7.89	357.1	357.1	357.4	0.3
W	20,020	118	656	10.67	361.1	361.1	361.1	0.0
X	20,200	178	1,098	6.38	363.6	363.6	363.6	0.0
Y	20,960	185	870	8.05	367.2	367.2	367.2	0.0
Z	21,740	346	671	10.44	374.5	374.5	374.5	0.0
AE	25,900	212	1,115	6.28	398.3	398.3	398.7	0.4
AF	26,900	214	848	8.25	403.3	403.3	403.9	0.6
AG	27,840	199	922	7.59	410.8	410.8	410.8	0.0
AH	28,670	127	755	9.27	416.0	416.0	416.0	0.0
AI	29,380	204	913	7.67	421.5	421.5	421.7	0.2
AJ	30,380	200[2]	908	7.71	427.9	427.9	428.6	0.7

[1] Feet Above Mouth [2] Floodway Lies Entirely Outside Corporate Limits

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

SOUTH PRAIRIE CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Chambers Creek								
A	8,790	184	214	5.61	59.9	59.9	59.9	0.0
B	9,410	323	412	2.91	67.9	67.9	67.9	0.0
C	10,120	185	305	3.93	75.0	75.0	75.0	0.0
D	10,750	143	380	3.15	80.5	80.5	80.5	0.0
E	11,350	93	175	6.86	87.0	87.0	87.0	0.0
F	11,970	234	418	2.87	95.4	95.4	95.4	0.0
G	12,600	251	347	3.46	100.5	100.5	100.5	0.0
H	13,330	44	178	6.34	106.1	106.1	106.1	0.0
I	13,890	58	153	6.93	110.6	110.6	110.6	0.0
J	13,950	164	289	3.66	111.5	111.5	111.5	0.0
K	14,120	36	125	8.48	112.4	112.4	112.4	0.0
L	14,180	54	132	8.04	113.8	113.8	113.8	0.0
M	14,830	178	270	3.92	120.8	120.8	120.8	0.0
N	15,460	51	140	7.5	126.8	126.8	126.8	0.0
O	16,190	41	124	8.57	137.2	137.2	137.2	0.0
P	16,780	51	154	6.86	145.2	145.2	145.2	0.0
Q	17,460	28	114	9.27	155.8	155.8	155.8	0.0
R	17,530	43	121	8.73	157.8	157.8	157.8	0.0
S	18,010	115	197	5.83	165.1	165.1	165.1	0.0
T	18,510	45	144	7.36	170.2	170.2	170.2	0.0
U	18,580	46	172	6.16	171.2	171.2	171.2	0.0
V	19,270	72	183	5.79	176.5	176.5	176.5	0.0
W	19,840	38	110	9.62	184.7	184.7	184.7	0.0
X	19,920	46	159	6.68	186.7	186.7	186.7	0.0
Y	20,000	109	176	6.02	187.5	187.5	187.5	0.0
Z	20,640	45	120	8.80	193.7	193.7	193.7	0.0
AA	21,250	47	196	5.40	202.2	202.2	202.2	0.0

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CHAMBERS CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Clover Creek								
A	200	38	77	8.74	210.2	208.4[2]	208.4[2]	0.0
B	220	37	90	7.53	210.7	210.7	210.7	0.0
C	675	46	76	8.88	217.9	217.9	217.9	0.0
C	690	28	73	9.43	221.2	221.2	221.2	0.0
E	725	33	76	9.16	223.2	223.2	223.2	0.0
F	805	32	142	4.89	223.8	223.8	223.8	0.0
G	840	58	145	4.77	225.9	225.9	225.9	0.0
H	1,220	45	88	7.90	235.2	235.2	235.2	0.0
I	1,970	36	85	8.19	249.3	249.3	249.3	0.0
J	2,220	33	101	6.85	253.3	253.3	253.3	0.0
K	2,260	47	129	5.38	253.8	253.8	253.8	0.0
L	2,340	62	98	7.08	256.1	256.1	256.1	0.0
M	2,980	126	280	2.48	259.6	259.6	259.6	0.0
N	3,590	65	154	4.51	260.7	260.7	260.7	0.0
O	4,230	52	182	3.80	262.8	262.8	262.8	0.0
P	4,950	53	174	3.98	264.5	264.5	265.4	0.0
Q	5.600	83	270	2.57	265.7	265.7	265.7	0.0
R	6,200	74	313	2.22	267.1	267.1	267.1	0.0
S	6,820	50	228	3.04	267.6	267.6	267.6	0.0
T	6,890	31	152	4.57	268.1	268.1	268.1	0.0
U	7.020	46	238	2.98	268.1	268.1	268.1	0.0
V	7,100	50	187	3.71	267.9	267.9	268.0	0.1
W	7,520	50	224	3.10	268.5	268.5	268.6	0.1
X	7,800	41	167	4.15	268.9	268.9	268.9	0.0
Y	8,170	48	173	4.00	269.6	269.8	269.8	0.0
Z	8,540	45	187	3.71	270.4	270.4	270.4	0.0

[1] Feet Above Mouth

[2] Elevation Computed Without Consideration of Backwater From Steilacoom Lake

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CLOVER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Clover Creek (Cont'd)								
AA	8,640	97	200	3.46	270.6	270.6	270.6	0.0
AB	9,240	50	185	3.74	271.7	271.7	271.8	0.1
AC	9,620	29	152	4.56	272.2	272.2	272.4	0.2
AD	9,920	60	269	2.57	273.1	273.1	273.3	0.2
AE	10,345	60	282	2.45	274.0	274.0	274.2	0.2
AF	10,550	60	268	2.59	274.1	274.1	274.3	0.2
AG	20,520	53	218	2.28	280.0	280.0	280.0	0.0
AH	20,930	60	306	1.62	280.3	280.3	280.3	0.0
AI	21,350	60	182	2.73	280.5	280.5	280.5	0.0
AJ	22,050	60	223	2.23	281.0	281.0	281.4	0.4
AK	22,840	70	277	1.79	281.2	281.2	282.0	0.8
AL	23,470	80	362	1.37	281.2	281.3	282.2	0.9
AM	24,165	31	58	7.48	284.3	284.3	284.3	0.0
AN	24,240	34	80	5.43	286.0	286.0	286.0	0.0
AO	24,780	35	101	4.31	287.9	287.9	287.9	0.0
AP	25,390	38	120	3.63	289.0	289.0	289.0	0.0
AQ	26,000	34	105	4.16	289.7	289.7	289.7	0.0
AR	26,110	32	102	4.27	289.9	289.9	289.9	0.0
AS	26,900	38	145	3.02	291.2	291.2	291.2	0.0
AT	27,575	[illegible]	125	3.48	291.9	291.9	291.9	0.0
AU	27,640	85	116	3.77	292.0	292.0	292.0	0.0
AV	28,200	48	141	3.09	292.9	292.9	292.9	0.0
AW	28,440	33	88	4.99	294.3	294.3	294.3	0.0
AX	29,560	49	117	3.74	297.0	297.0	297.0	0.0
AY	29,630	37	89	4.88	297.1	297.1	297.1	0.0
AZ	30,180	109	172	2.54	298.3	298.3	298.3	0.0

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CLOVER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Clover Creek (Cont'd)								
BA	30,320	48	145	3.01	298.5	298.5	298.5	0.0
BE	30,930	35	93	4.71	299.6	299.6	299.6	0.0
BC	31,030	137	248	1.76	300.5	300.5	300.5	0.0
BD	33,150	22	75	5.82	300.6	300.6	300.6	0.0
BE	31,420	32	78	5.62	301.9	301.9	301.9	0.0
BF	31,510	31	87	5.01	302.4	302.4	302.4	0.0
BG	31,840	46	147	2.97	303.2	303.2	303.2	0.0
BH	31,940	34	99	4.40	303.4	303.4	303.4	0.0
BI	32,230	36	118	3.70	304.1	304.1	304.1	0.0
BJ	32,340	36	132	3.30	304.4	304.4	304.4	0.5
BK	33,130	50	220	1.85	304.5	304.5	305.0	0.5
BL	33,200	80	125	2.08	305.3	305.3	305.3	0.0
BM	33,690	80	236	1.10	305.4	305.5	305.8	0.4
BN	34,100	78	152	1.71	305.5	305.5	305.9	0.4
BO	34,260	40	111	2.33	306.3	306.3	306.5	0.2
BP	34,770	36	51	5.06	308.7	308.7	308.9	0.2
BQ	35,180	40	112	2.32	310.2	310.2	310.6	0.4
BR	35,325	40	154	1.69	310.2	310.2	310.8	0.6
BS	36,030	60	166	1.56	310.3	310.3	311.1	0.8
BT	36,775	80	147	1.77	310.8	310.8	31.8	1.0
BU	37,600	80	122	2.13	313.2	313.2	314.6	0.4
BV	38,480	80	217	1.20	313.4	313.4	314.4	1.0
BW	39,440	40	99	2.10	314.7	314.7	315.1	0.4
BX	40,100	40	127	1.64	315.1	315.1	315.6	0.5
BY	40,520	40	85	2.54	315.5	315.5	315.9	0.4
BZ	40,720	40	79	2.65	316.1	316.1	316.3	0.2

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CLOVER CREEK

BEST COPY AVAILABLE

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
						(FEET NGVD)		
Clover Creek (Cont'd)								
CA	41,060	40	92	2.25	316.5	316.5	316.8	0.3
CB	41,840	45	159	1.31	316.8	316.8	317.3	0.5
CC	41,880	40	124	1.68	316.8	316.8	317.3	0.5
CD	42,420	40	155	1.34	316.9	316.9	317.5	0.6
CE	43,030	4	167	1.24	317.0	317.0	317.6	0.6
CF	43,540	47	174	0.91	317.0	317.0	317.7	0.7
CG	43,600	50	218	0.78	317.0	317.0	317.7	0.7
CH	44,100	50	183	0.86	317.1	317.1	317.8	0.7
CI	44,700	50	174	0.91	317.1	317.1	317.8	0.7
CJ	45,340	50	94	1.67	317.4	317.4	318.0	0.6
CK	45,400	60	62	2.54	317.5	317.5	318.0	0.5
CL	45,960	60	176	0.90	317.6	317.6	318.6	1.0
CM	46,810	40	53	2.02	318.4	318.4	318.8	0.4
CN	47,480	50	142	1.12	319.0	319.0	319.3	0.3
CO	48,170	39	80	1.99	319.3	319.3	319.5	0.2
CP	48,720	40	91	1.73	319.7	319.7	31.9	0.2
CQ	49,130	36	102	1.56	319.8	319.8	320.1	0.3
CR	49,250	50	148	1.07	320.1	320.1	320.3	0.2
CS	49,770	50	116	1.37	320.3	320.3	320.5	0.5
CT	50,390	47	100	1.58	320.5	320.5	320.7	0.2
CU	50,990	50	114	1.38	320.7	320.7	321.0	0.3
CV	51,600	27	72	2.20	320.9	320.9	321.4	0.5
CW	52,280	50	81	1.96	322.0	322.0	322.1	0.1
CX	52,860	31	93	1.71	322.3	322.3	322.8	0.5
CY	53,480	60	136	1.16	322.3	322.3	323.3	1.0
CZ	54,160	50	121	1.30	322.5	322.5	323.5	1.0

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[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CLOVER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Clover Creek (Cont'd)								
DA	54,720	60	106	1.49	323.0	323.0	323.7	0.7
DB	55,370	60	68	2.31	324.0	324.0	324.8	0.8
DC	55,430	53	122	0.96	324.9	324.9	325.4	0.5
DD	56,130	50	127	0.93	325.1	325.1	325.5	0.4
DE	56,850	50	80	1.47	325.3	325.3	325.8	0.5
DF	56,910	50	106	1.12	325.3	325.3	325.8	0.5
DG	57,700	50	110	1.07	325.5	325.5	326.1	0.6
DH	58,400	50	97	1.22	325.6	325.6	325.6	0.7

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

CLOVER CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY (FEET NGVD)	WITH FLOODWAY (FEET NGVD)	INCREASE
Leach Creek								
N	6,100	83	153	1.44	178.9	178.9	178.9	0.0
O	6,770	40	144	1.53	179.1	179.1	179.2	0.1
P	6,825	40	152	1.45	179.3	179.3	179.3	0.0
Q	7,380	40	137	1.60	179.4	179.4	179.6	0.2
R	7,430	40	120	1.83	179.4	179.4	179.6	0.2
S	8,100	50	136	1.54	179.8	179.8	180.0	0.2
T	9,150	40	98	2.13	180.7	180.7	181.1	0.4
U	10,350	40	64	3.30	183.5	183.5	183.7	0.2
V	10,900	40	54	3.67	186.6	186.6	186.6	0.0
W	11,490	25	50	3.99	190.4	190.4	190.4	0.0

[1] Feet Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

LEACH CREEK

FLOODING SOURCE		FLOODWAY			BASE FLOOD WATER SURFACE ELEVATION			
CROSS SECTION	DISTANCE[1]	WIDTH (FEET)	SECTION AREA (SQUARE FEET)	MEAN VELOCITY (FEET PER SECOND)	REGULATORY	WITHOUT FLOODWAY	WITH FLOODWAY	INCREASE
					(FEET NGVD)			
Muck Creek (At Roy)								
A	6.004	49	162	5.91	306.4	306.4	306.4	0.0
B	6.093	58	215	4.47	309.3	309.3	309.3	0.0
C	6.398	55	190	5.05	315.4	315.4	315.9	0.5

---

[1] Miles Above Mouth

TABLE 3

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOODWAY DATA

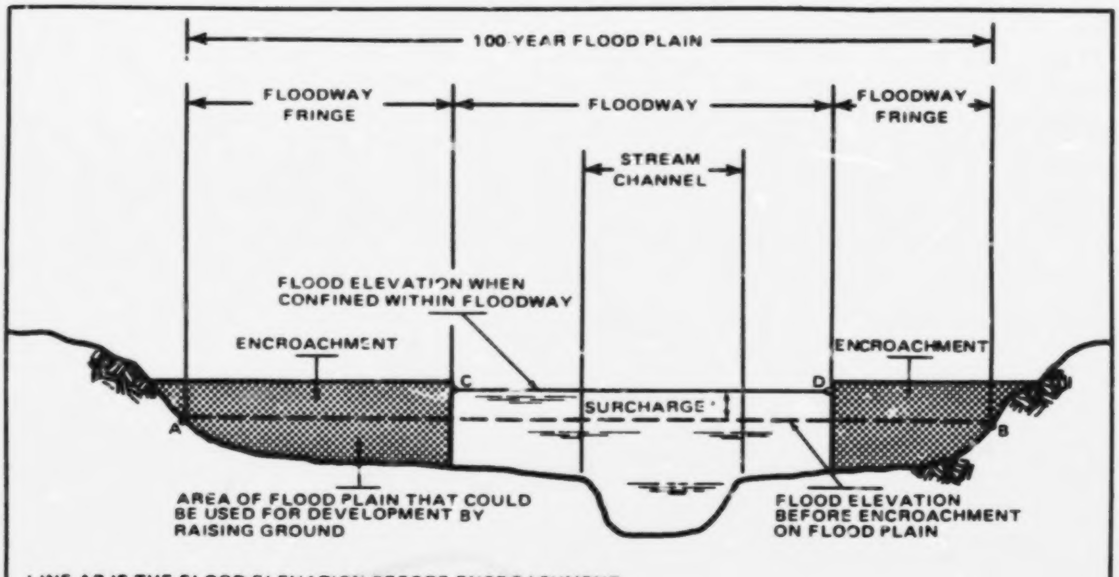
MUCK CREEK (AT ROY)

In addition, Pierce County has adopted the 100-year flood boundary as the floodway on the entire detailed-study reach of Ohop, Tanwax, South, and Muck Creeks, (excluding Muck Creek (at Roy)), South Creek Tributary No. 3 and the Greenwater River; and on portions of Horn, Unnamed, Lacamas, Swan, and South Prairie Creeks, and the Nisqually and White Rivers.

On most of the above-mentioned streams where the 100-year flood boundary and floodway are coincident, no floodway data has been presented. At the request of the Pierce County Public Works Department, floodway data (Table 3) is presented for the entire detailed study reaches Chambers, of Clover and Hylebos Creeks, South Creek Tributary No. 1, and Puyallup River.

As shown on the Flood Boundary and Floodway Map (Exhibit 2), the floodway boundaries were computed at cross sections. Between cross sections, the boundaries were interpolated. In cases where the floodway and 100-year flood plain boundaries are either close together or collinear, only the floodway boundary has been shown.

The area between the floodway and 100-year flood plain boundaries is termed the floodway fringe. The floodway fringe encompasses the portion of the flood plain that could be completely obstructed without increasing the water-surface elevation of the 100-year flood by more than 1.0 foot at any point. Typical relationships between the floodway and the floodway fringe and their significance to flood plain development are shown in Figure 8.


100-YEAR FLOOD PLAIN
FLOODWAY FRINGE
FLOODWAY
FLOODWAY FRINGE
STREAM CHANNEL
FLOOD ELEVATION WHEN CONFINED WITHIN FLOODWAY
ENCROACHMENT
ENCROACHMENT
C
D
SURCHARGE*
A
B
AREA OF FLOOD PLAIN THAT COULD BE USED FOR DEVELOPMENT BY RAISING GROUND
FLOOD ELEVATION BEFORE ENCROACHMENT ON FLOOD PLAIN

LINE AB IS THE FLOOD ELEVATION BEFORE ENCROACHMENT.
LINE CD IS THE FLOOD ELEVATION AFTER ENCROACHMENT.
*SURCHARGE IS NOT TO EXCEED 1.0 FOOT (FEMA REQUIREMENT) OR LESSER AMOUNT IF SPECIFIED BY STATE.

Figure 8. Floodway Schematic

5.0 INSURANCE APPLICATION

To establish actuarial insurance rates, data from the engineering study must be transformed into flood insurance criteria. This process includes the determination of reaches, Flood Hazard Factors, and flood insurance zone designations for each flooding source studied in detail affecting Pierce County.

5.1 Reach Determinations

Reaches are defined as sections of flood plain that have relatively the same flood hazard. In riverine areas, reaches are based on the average weighted difference in water-surface elevations between the 10- and 100-year floods. This difference may not have a variation greater than that indicated in the following table for more than 20 percent of the reach:

Average Difference Between 10- and 100-Year Floods	Variation
Less than 2 feet	0.5 foot
2 to 7 feet	1.0 foot
7.1 to 12 feet	2.0 feet
More than 12 feet	3.0 feet

The locations of the reaches determined for the riverine flooding sources of Pierce County are shown on the Flood Profiles (Exhibit 1) and summarized in Table 4.

For lacustrine and tidal areas, reaches are limited to the distance for which the 100-year flood elevation does not vary more than 1.0 foot. Using these criteria, 16 reaches were required for the flooding sources of Pierce County. The locations of these reaches are shown on the Flood Insurance Rate Map and summarized in Table 4.

5.2 Flood Hazard Factors

The Flood Hazard Factor (FHF) is used to establish relationships between depth and frequency of flooding in any reach. This relationship is then used with depth-damage relationships for various classes of structures to establish actuarial insurance rate tables.

The FHF for a reach is the average weighted difference between the 10- and 100-year flood water-surface elevations rounded to the nearest one-half foot, multiplied by 10, and shown as a three-digit code. For example, if the difference between water-surface

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Leach Creek							
Reach 1	0282,0284	-1.0	-0.3	1.2	010	A2	Varies - See Map
Reach 2	0282	-1.6	-0.6	0.6	015	A3	Varies - See Map
Chambers Creek							
Reach 1	0283,0284 0291,0292	-0.9	-0.2	0.5	010	A2	Varies - See Map
Clover Creek							
Reach 1	0292,0294 0313	-1.2	-0.3	0.5	010	A2	Varies - See Map
Reach 2	0314,0318 0319,0556 0557,0576	-0.6	-0.2	0.3	005	A1	Varies - See Map
Shallow Flooding	0576	N/A	N/A	N/A	N/A	AH	33'
Spanaway Creek							
Reach 1	0314,0552	-0.4	-0.1	0.3	005	A1	Varies - See Map
North Fork Clover Creek							
Reach 1	0318,0319	-0.3	-0.1	0.2	005	A1	Varies - See Map
Nisqually River							
Reach 1	0505	-0.8	-0.3	1.3	010	A2	Varies - See Map
Reach 2	0505,0520	-2.3	-0.7	2.0	025	A5	Varies - See Map
Reach 3	0520,0830	-1.9	-0.6	1.5	020	A4	Varies - See Map
Reach 4	0830	-3.5	-1.1	2.6	035	A7	Varies - See Map
Reach 5	0830	-2.6	-0.8	2.2	025	A5	Varies - See Map
Reach 6	0830,0835	-3.3	-1.1	2.8	035	A7	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

LEACH CREEK-CHAMBERS CREEK-CLOVER CREEK-SPANAWAY CREEK-
NORTH FORK CLOVER CREEK-NISQUALLY RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Nisqually River (Cont'd)							
Reach 7	0830,0835 0845	-2.4	-0.8	2.0	025	A5	Varies - See Map
Reach 8	0845,0865	-3.2	-0.9	2.3	030	A6	Varies - See Map
Reach 9	0865,1080 1082,1085 1105	-2.0	-0.7	1.8	020	A4	Varies - See Map
Reach 10	1190,1330 1335	-1.1	-0.3	0.7	010	A2	Varies - See Map
Horn Creek							
Reach 1	0865	-0.6	-0.2	0.3	005	A1	Varies - See Map
Ohop Creek							
Reach 1	1105	-1.5	-0.5	1.0	015	A3	Varies - See Map
Reach 2	0890,1105	-0.6	-0.1	0.4	005	A1	Varies - See Map
Reach 3	0890,0895 1105,1110	-0.9	-0.6	0.5	010	A2	Varies - See Map
Reach 4	0885,0895 0905	-0.4	-0.1	0.2	005	A1	Varies - See Map
Mashel River							
Reach 1	1107,1126	-1.3	-0.4	0.8	015	A3	Varies - See Map
Little Mashel River							
Reach 1	1107	-1.7	-0.4	0.9	015	A3	Varies - See Map
Reach 2	1107,1126	-0.9	-0.2	0.5	010	A2	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

NISQUALLY RIVER-HORN CREEK-OHOP CREEK-MASHEL RIVER-LITTLE MASHEL RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Unnamed Creek							
Reach 1	0869,0890 1082	-0.3	-0.1	0.2	005	A1	Varies - See Map
Tanwax Creek							
Reach 1	0890	-0.3	-0.1	0.2	005	A1	Varies - See Map
Reach 2	0890	-1.3	-0.4	1.0	015	A3	Varies - See Map
Reach 3	0883,0885 0890,0895	-0.4	-0.1	0.2	005	A1	Varies - See Map
South Creek							
Reach 1	0877,0878 0879,0881 0883	-0.5	-0.1	0.3	005	A1	Varies - See Map
Reach 2	0881	-1.6	-0.5	0.6	015	A3	Varies - See Map
South Creek Tributary No. 1							
Reach 1	0593,0877 0881	-0.7	-0.2	0.4	005	A1	Varies - See Map
South Creek Tributary No. 2							
Reach 1	0877,0881	-0.5	-0.2	0.2	005	A1	Varies - See Map
South Creek Tributary No. 3							
Reach 1	0878	-0.3	-0.1	0.2	005	A1	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

UNNAMED CREEK-TANWAX CREEK-SOUTH CREEK-SOUTH CREEK TRIBUTARY NO. 1-
SOUTH CREEK TRIBUTARY NO. 2-SOUTH CREEK TRIBUTARY NO. 3

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
South Creek Tributary No. 4							
Reach 1	0878	-0.6	-0.2	0.3	005	A1	Varies - See Map
Lacamas Creek							
Reach 1	0545,0835						
	0851,0852						
	0854,0856	-0.5	-0.1	0.3	005	A1	Varies - See Map
Puyallup River							
Reach 1	0307	-1.7	0.0	0.7	015	A3	Varies - See Map
Reach 2	0307,0326						
	0328,0329	-2.3	0.0	0.9	025	A5	Varies - See Map
Reach 3	0329,0333						
	0334,0353						
	0354,0361						
	0362,0363						
	0364,0601						
	0602,0604	-2.1	-0.4	1.1	020	A4	Varies - See Map
Reach 4	0604,0615						
	0620,0905						
	0910	-1.2	-0.3	0.8	010	A2	Varies - See Map
Swan Creek							
Reach 1	0307	-1.6	-0.2	1.4	015	A3	Varies - See Map
Reach 2	0307,0309	-0.4	-0.1	0.2	005	A1	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SOUTH CREEK TRIBUTARY NO. 4-LACAMAS CREEK-
PUYALLUP RIVER-SWAN CREEK

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Squally Creek							
Reach 1	0307,0309	-0.4	-0.1	0.2	005	A1	Varies - See Map
Clear Creek							
Reach 1	0326,0328	-1.4	-0.1	0.7	015	A3	Varies - See Map
Reach 2	0309,0328	-0.3	-0.1	0.2	005	A1	Varies - See Map
Wapato Creek I							
Reach 1	0326,0327	-1.0	-0.4	1.0	010	A2	Varies - See Map
Reach 2	0327,0329 0331,0333	-0.5	-0.1	0.3	005	A1	Varies - See Map
Wapato Creek II							
Reach 1	0333	-0.4	-0.2	0.4	005	A1	Varies - See Map
Shallow Flooding	0333,0334	N/A	N/A	N/A	N/A	AH	50
Hylebos Creek							
Reach 1	0188,0189 0326,0327	-1.6	-0.4	0.6	015	A3	Varies - See Map
White River							
Reach 1	0334,0353	-2.3	0.0	1.0	025	A5	Varies - See Map
Reach 2	0334,0351 0353	-2.1	-0.2	1.1	020	A4	Varies - See Map
Reach 3	0351	-1.5	-0.3	1.0	015	A3	Varies - See Map
Reach 4	0213,0351	-0.9	-0.2	0.7	010	A2	Varies - See Map
Reach 5	0411	-0.4	-0.2	0.4	005	A1	Varies - See Map
Reach 6	0470,0490 0730	-1.9	-0.5	1.1	020	A4	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SQUALLY CREEK-CLEAR CREEK-WAPATO CREEK I-WAPATO CREEK II-
HYLEBOS CREEK-WHITE RIVER

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Salmon Creek							
Reach 1	0353,0354	-0.6	-0.1	0.4	005	A1	Varies - See Map
Carbon River - With Consideration of Levees							
Reach 1	0363,0601 0602,0604 0610	-1.5	-0.5	0.9	015	A3	Varies - See Map
Reach 2	0610,0630	-1.1	-0.3	0.7	010	A2	Varies - See Map
Carbon River - Without Consideration of Levees							
Reach 1	0363,0601 0602,0604 0610	-1.2	-0.3	0.7	010	A2	Varies - See Map
South Prairie Creek							
Reach 1	0610	-1.6	-0.4	0.8	015	A3	Varies - See Map
Reach 2	0369,0610	-0.9	-0.2	0.5	010	A2	Varies - See Map
Reach 3	0369,0388 0400	-1.5	-0.4	0.8	015	A3	Varies - See Map
Greenwater River							
Reach 1	0470	-2.7	-0.9	1.8	025	A5	Varies - See Map
Reach 2	0470,0490	-1.9	-0.5	1.2	020	A4	Varies - See Map
Reach 3	0490	-1.3	-0.4	0.8	015	A3	Varies - See Map

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

SALMON CREEK-CARBON RIVER (WITH CONSIDERATION OF LEVEES)-
CARBON RIVER (WITHOUT CONSIDERATION OF LEVEES)-SOUTH PRAIRIE CREEK-GREENWATER RIVER

BEST COPY AVAILABLE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND 10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)	FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
Wilkeson Creek							
Reach 1	0631	-1.0	-0.3	0.6	010	A2	Varies - See Map
Fennel Creek							
Reach 1	0366	-0.4	-0.1	0.2	005	A1	Varies - See Map
Debra Jane Creek							
Reach 1	0366	-0.3	-0.1	0.1	005	A1	Varies - See Map
Reach 2	0366	-1.6	-0.5	1.3	015	A3	494
Reach 3	0366	-0.2	-0.1	0.1	005	A1	Varies - See Map
Bonney Lake Outflow							
Reach 1	0366	-0.1	0.0	0.1	005	A1	Varies - See Map
Muck Creek							
Reach 1	0545	-0.8	-0.2	0.5	010	A2	Varies - See Map
Kreger Lake							
Reach 1	1082	-0.4	-0.1	0.1	005	A1	532
Silver Lake							
Reach 1	0869,0890	-0.3	-0.1	0.2	005	A1	607
Rapjohn Lake							
Reach 1	0890	-0.3	-0.1	0.2	005	A1	636

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

WILKESON CREEK-FENNEL CREEK-DEBRA JANE CREEK-BONNEY LAKE OUTFLOW-
MUCK CREEK-KREGER LAKE-SILVER LAKE-RAPJOHN LAKE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION (FEET NGVD)[3]
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
American Lake Reach 1	0290,0293 0530,0535	-0.6	-0.1	0.5	005	A1	236
Gravelly Lake Reach 1	0293,0294	-0.2	0.0	0.2	005	A1	220
Spanaway Lake Reach 1	0552	-0.6	-0.2	0.3	005	A1	324
Ohop Lake Reach 1	0895	-1.0	-0.3	0.7	010	A2	525
Tanwax Lake Reach 1	0885	-0.4	-0.1	0.2	005	A1	602
Lake Louise Reach 1	0290	-0.3	-0.1	0.1	005	A1	226
Lake Kapowsin Reach 1	0905	-0.8	-0.2	0.5	010	A2	584
Steilacoom Lake Reach 1	0291,0292 0294	-1.3	-0.4	1.0	015	A3	210

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

AMERICAN LAKE-GRAVELLY LAKE-SPANAWAY LAKE-TANWAX LAKE-
LAKE LOUISE-LAKE KAPOWSIN-STEILACOOM LAKE

FLOODING SOURCE	PANEL[1]	ELEVATION DIFFERENCE[2] BETWEEN 1% (100-YEAR) FLOOD AND			FLOOD HAZARD FACTOR	ZONE	BASE FLOOD ELEVATION[3] (FEET NGVD)
		10% (10-YEAR)	2% (50-YEAR)	0.2% (500-YEAR)			
Harts Lake							
Reach 1	0865	-0.4	-0.1	0.2	005	A1	349
Little Lake							
Reach 1	0865	-0.4	-0.1	0.2	005	A1	349
Puget Sound							
Reach 1 (Nisqually)	0505,0510	-0.5	-0.1	0.3	005	V1,A1	10
Reach 2 (Day Island)	0150,0277 0281	-0.5	-0.1	0.3	005	V1,A1	9
Reach 3 (Commencement Bay)	0169,0188 0326	-0.5	-0.1	0.3	005	A1	9

[1] Flood Insurance Rate Map Panel [2] Weighted Average [3] Rounded to Nearest Foot

TABLE 4

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

FLOOD INSURANCE ZONE DATA

HARTS LAKE-LITTLE LAKE-PUGET SOUND

elevations of the 10- and 100-year floods is 0.7 foot, the FHF is 005; if the difference is 1.4 feet, the FHF is 015; if the difference is 5.0 feet, the FHF is 050. When the difference between the 10- and 100-year flood water-surface elevations is greater than 10.0 feet, it is rounded to the nearest whole foot.

5.3 Flood Insurance Zones

Flood insurance zones and zone numbers are assigned based on the type of flood hazard and the FHF, respectively. A unique zone number is associated with each possible FHF, and varies from 1 for a FHF of 005 to a maximum of 30 for a FHF of 200 or greater.

Zone A:	Special Flood Hazard Areas inundated by the 100-year flood, determined by approximate methods; no base flood elevations shown or FHFs determined.
Zone AH:	Special Flood Hazard Areas inundated by types of 100-year shallow flooding where depths are between 1.0 and 3.0 feet; base flood elevations are shown, but no FHFs are determined.
Zones A1-A7:	Special Flood Hazard Areas inundated by the 100-year flood; with base flood elevations shown, and zones subdivided according to FHFs.
Zone V1:	Special Flood Hazard Areas along coasts inundated by the 100-year flood that have additional velocity hazards associated with waves of 3-foot amplitude or greater; with base flood elevations shown, and zones subdivided according to FHFs.
Zone B:	Areas between the Special Flood Hazard Areas and the limits of the 500-year flood; areas that are protected from the 100- or 500-year floods by dike, levee, or other local water-control structure; areas subject to certain types of 100-year shallow flooding where depths are less than 1.0 foot; and areas subject to 100-year flooding from sources with drainage areas less than 1 square mile. Zone B is not subdivided.

Zone C: Areas of minimal flood hazard; not subdivided.

Zone D: Areas of undetermined, but possible flood hazard.

The flood elevation differences, FHFs, flood insurance zones, and base flood elevations for each flooding source studied in detail in the community are summarized in Table 4.

5.4 Flood Insurance Rate Map Description

The Flood Insurance Rate Map for Pierce County is, for insurance purposes, the principal product of the Flood Insurance Study. This map contains the official delineation of flood insurance zones and base flood elevations. Base flood elevation lines show the locations of the expected whole-foot water-surface elevation of the base (100-year) flood. The base flood elevations and zone numbers are used by insurance agents, in conjunction with structure elevations and characteristics, to assign actuarial insurance rates to structures and contents insured under the NFIP.

6.0 OTHER STUDIES

Flood Insurance Studies have been prepared for the Cities of Buckley, Fife, Orting, Pacific, Puyallup, Steilacoom, Sumner, and Tacoma (References 35-42, respectively); the Towns of Bonney Lake, Dupont, Fircrest, Gig Harbor, Milton, Roy, South Prairie, and Wilkeson (References 43-50, respectively); and King, Kitsap, Lewis, Mason, Thurston, and Yakima Counties (References 51-56, respectively). These studies are in general agreement with the data presented in this report.

Due to the more detailed analyses used, this study supersedes the previously published Flood Hazard Boundary Map for Pierce County (Reference 33).

Data presented for the Nisqually River in this study were compared with a flood profile report (Reference 57) and a report on the water resources of the Nisqually Indian Reservation (Reference 58). All three studies are in agreement.

A flood inundation study of the Parkland area of Clover Creek was prepared by the USGS in 1962 (Reference 59). Subsequent to the publication of the USGS study, structural improvements and channel changes have occurred. The changes are incorporated in the analyses presented in this Flood Insurance Study and supersede the USGS study.

A flood-control study of the Clover Creek basin was prepared by Consoer, Townsend, and Associates in 1977 (Reference 60), and coordination was maintained throughout the study.

Consoer, Townsend, and Associates also prepared flood-control reports on Hylebos Creek (Reference 61) and Upper Wapato Creek (Reference 62). This study was compared with the flood-control reports, and there were no major disagreements.

The COE has performed studies investigating flood hazards and methods of flood protection for the Puyallup and Carbon Rivers (References 13 and 63). Data from these analyses were used in performing the hydraulic analysis for this study.

7.0 LOCATION OF DATA

Information concerning the pertinent data used in the preparation of this study can be obtained by contacting the Natural and Technological Hazards Division, FEMA, Federal Regional Center, 130 228th Street, SW., Bothell, Washington 98021-9796.

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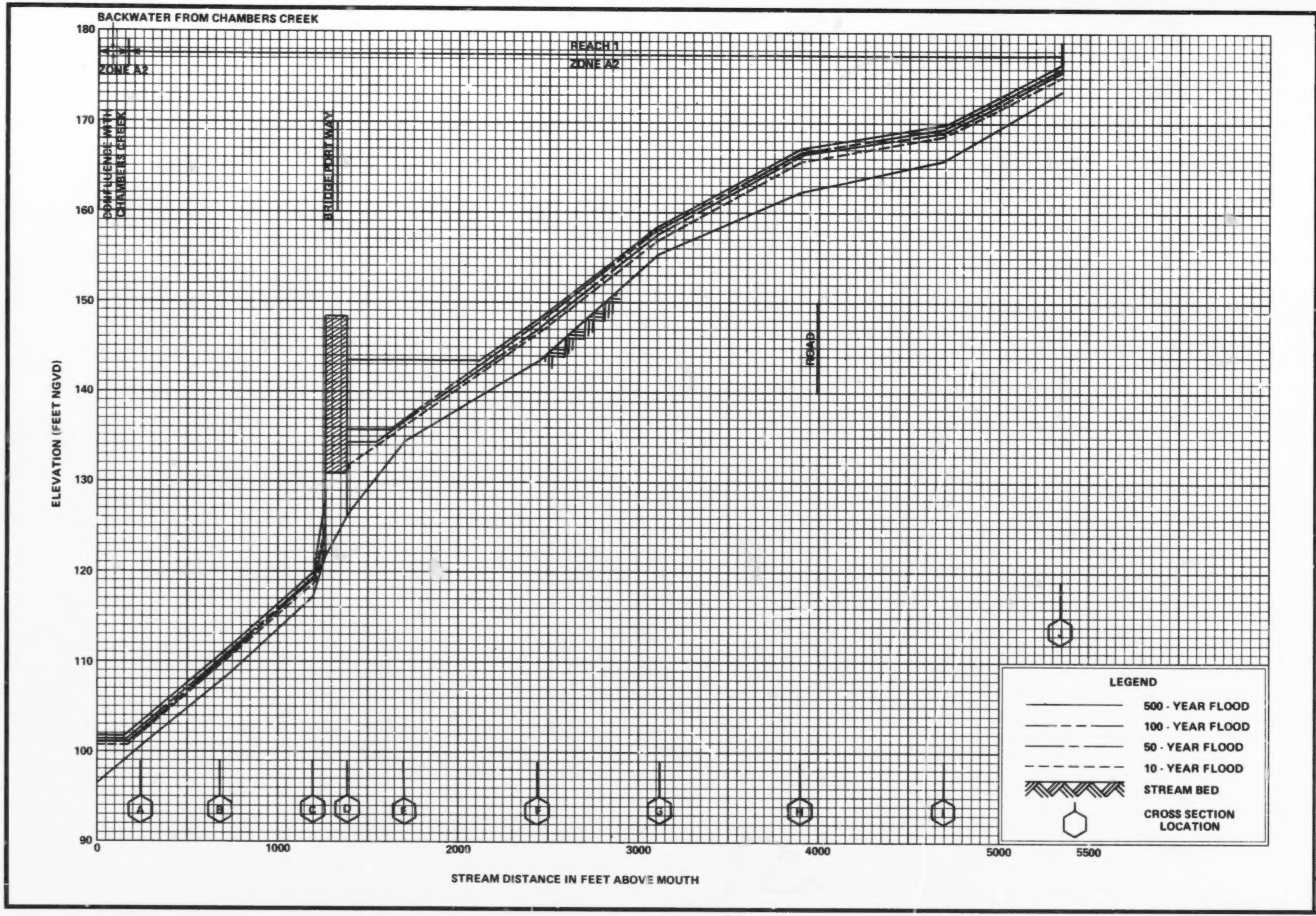

FLOOD PROFILES

LEACH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

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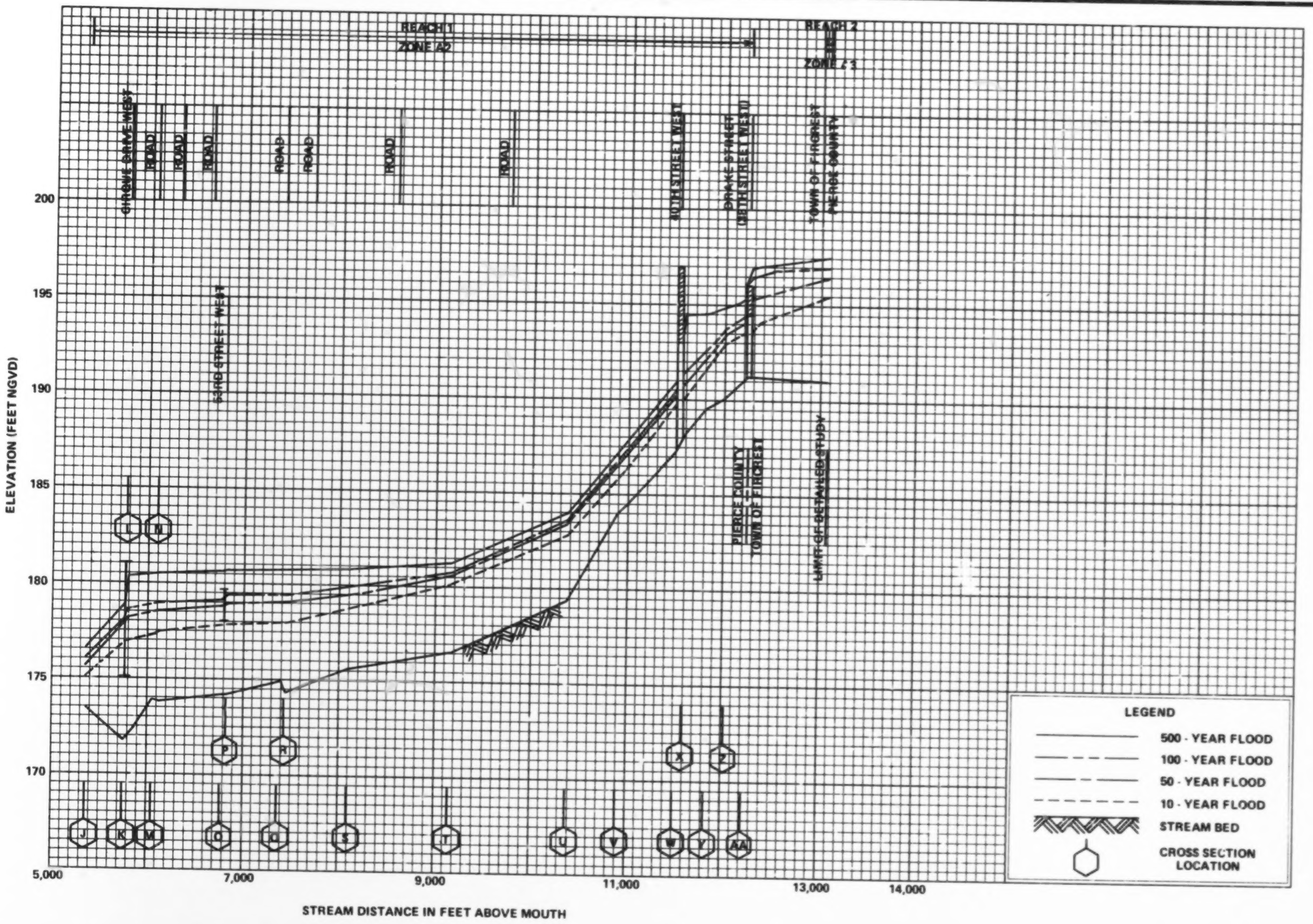

FLOOD PROFILES

LEACH CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

02P

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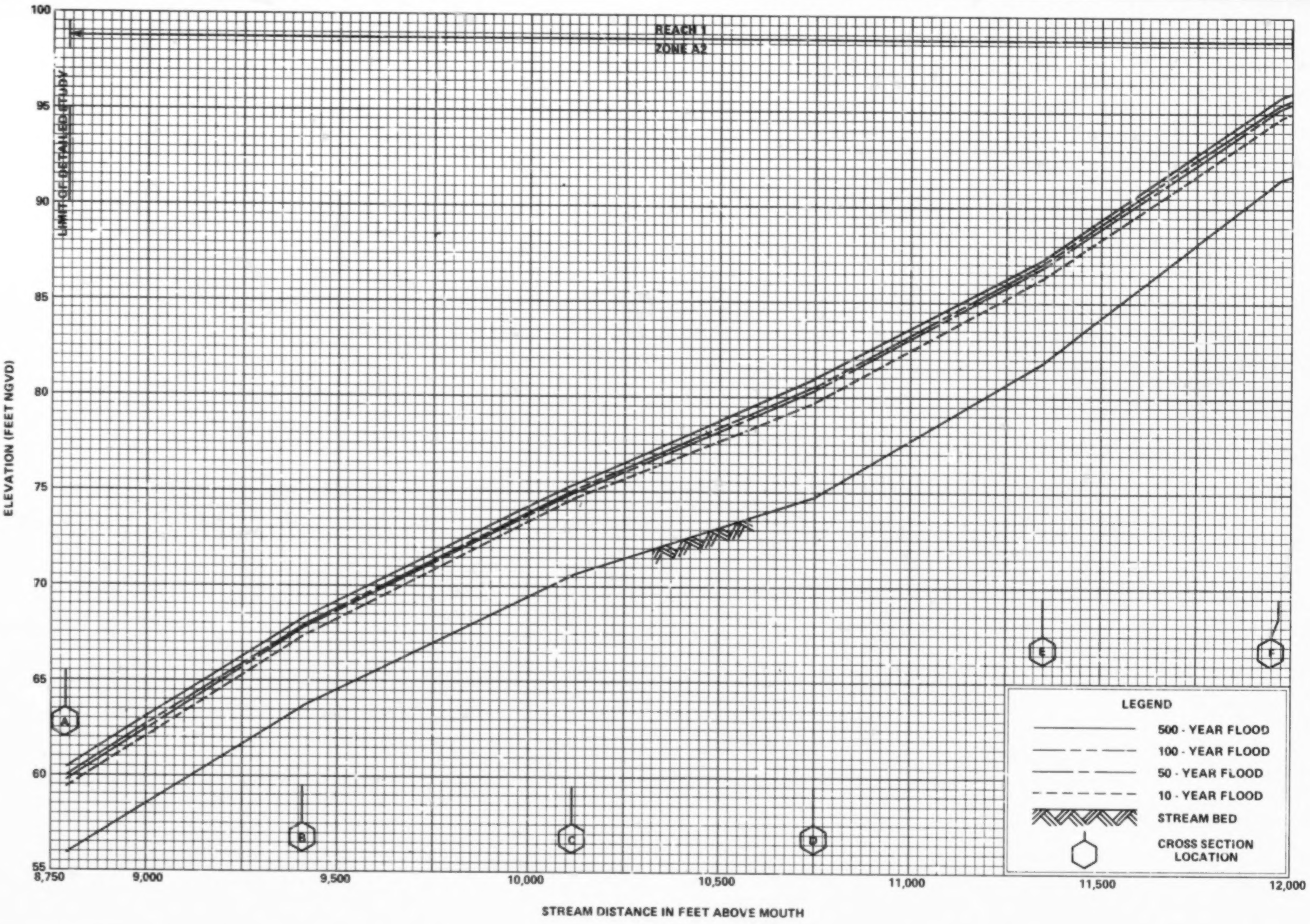

FLOOD PROFILES

CHAMBERS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
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03P

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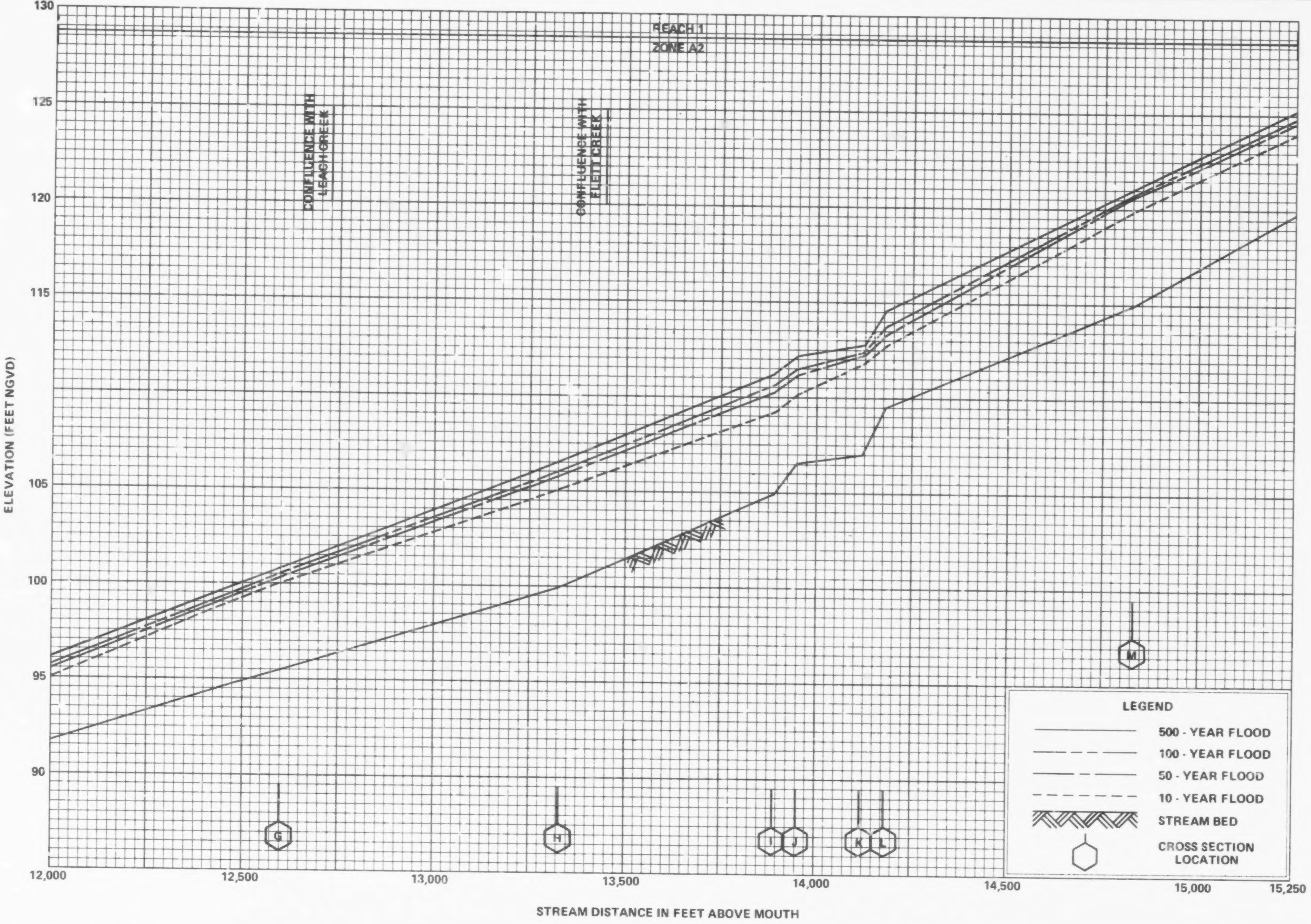

FLOOD PROFILES

CHAMBERS CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

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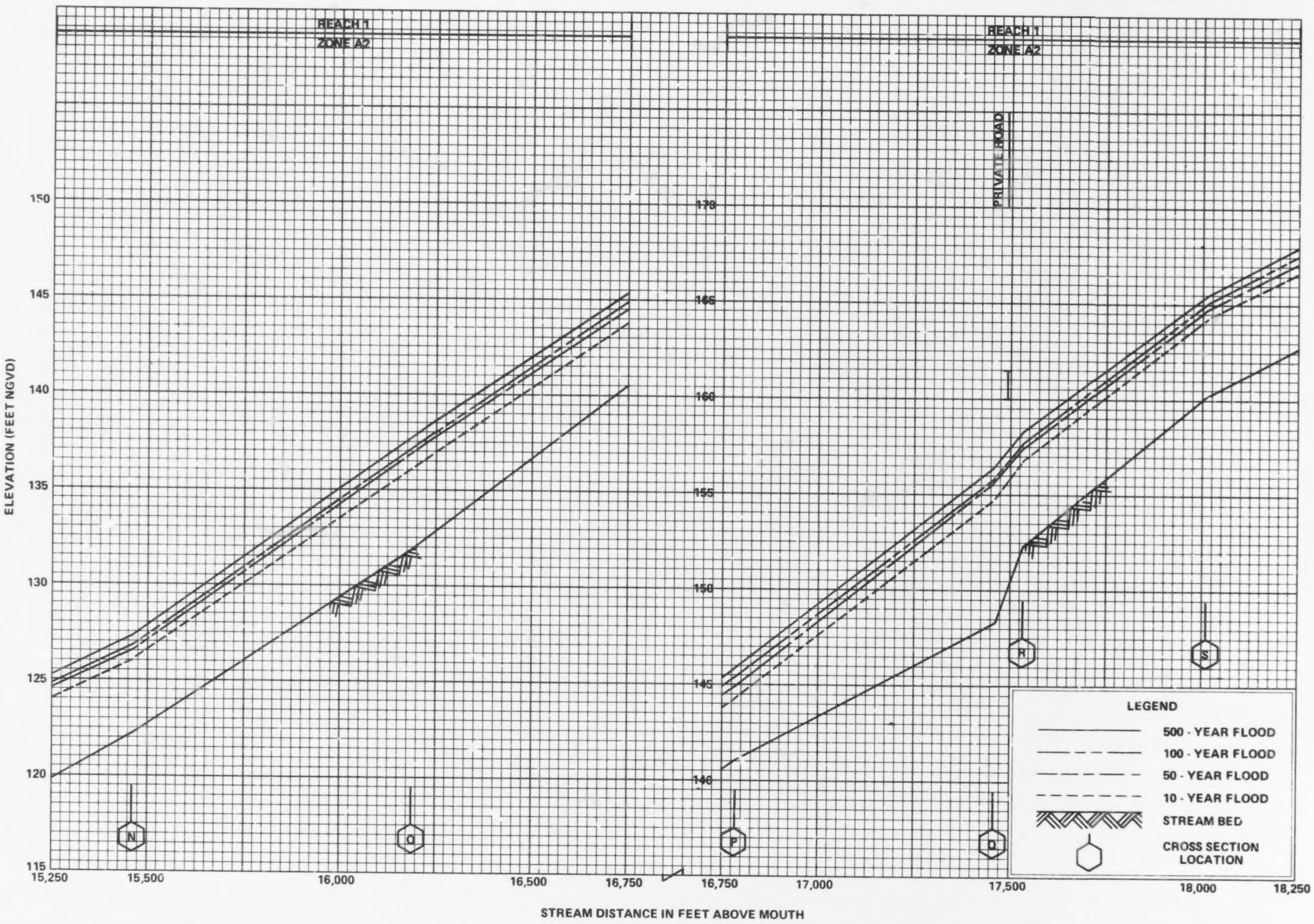

FLOOD PROFILES

CHAMBERS CREEK

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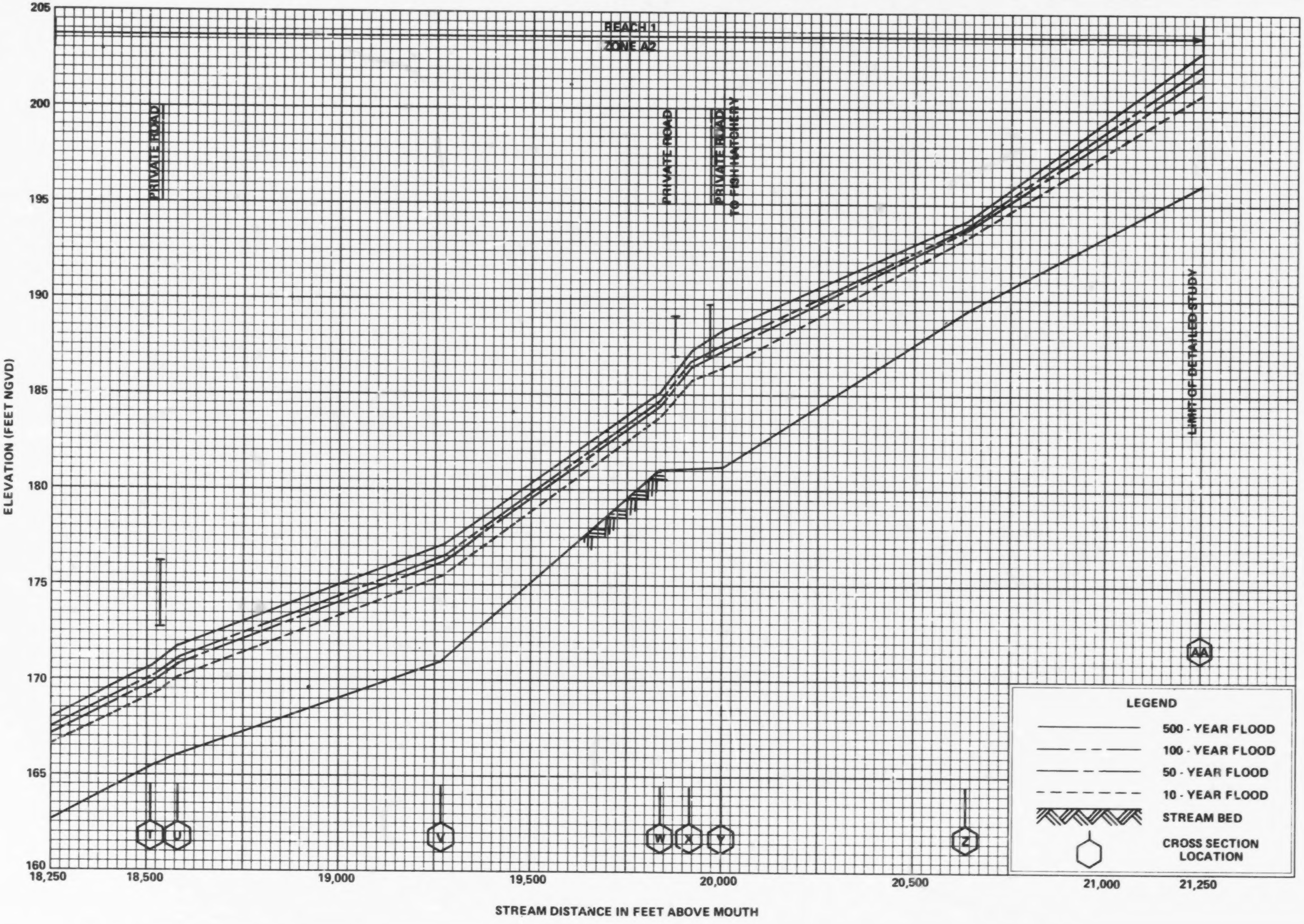

FLOOD PROFILES

CHAMBERS CREEK

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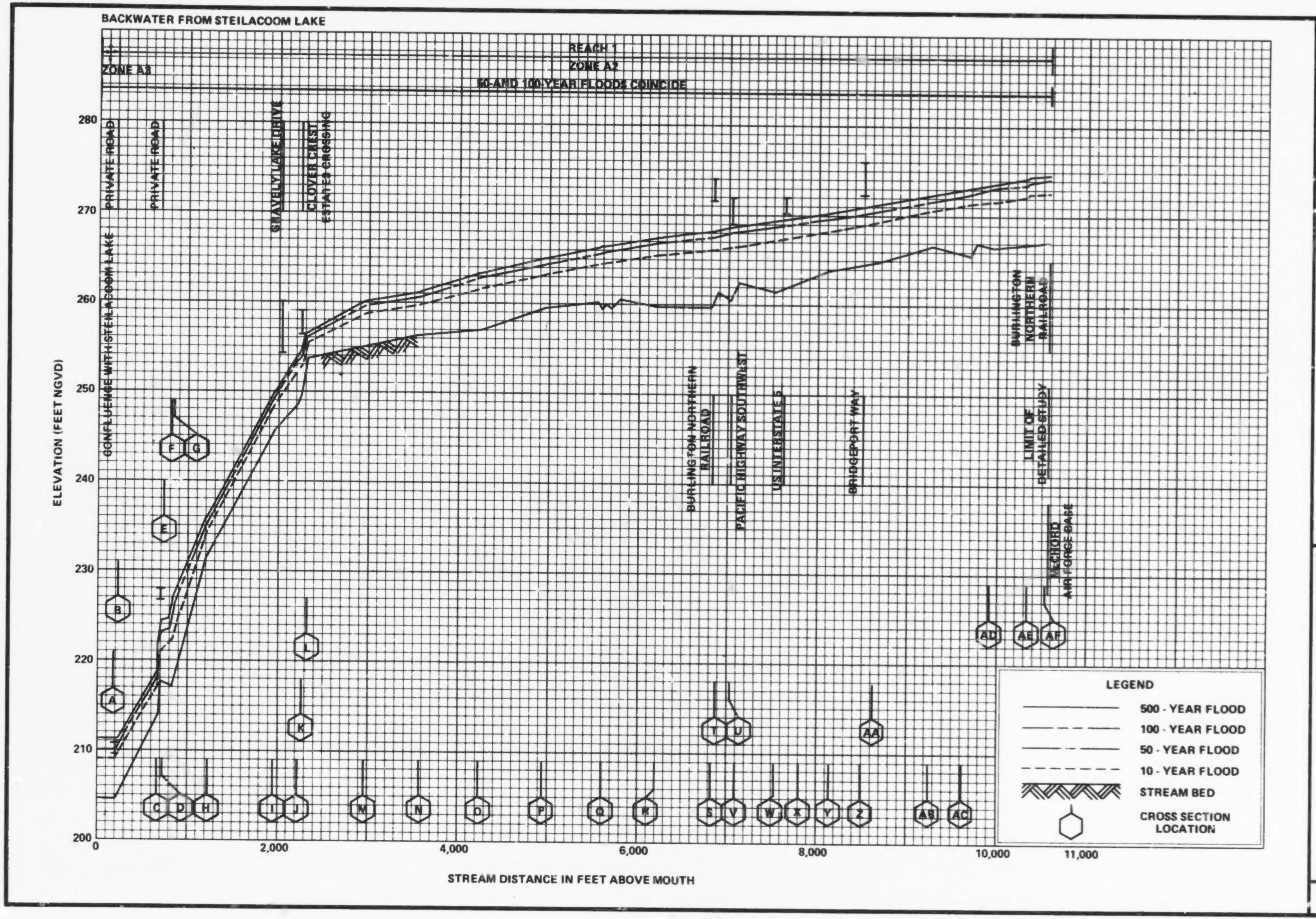

FLOOD PROFILES

CLOVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
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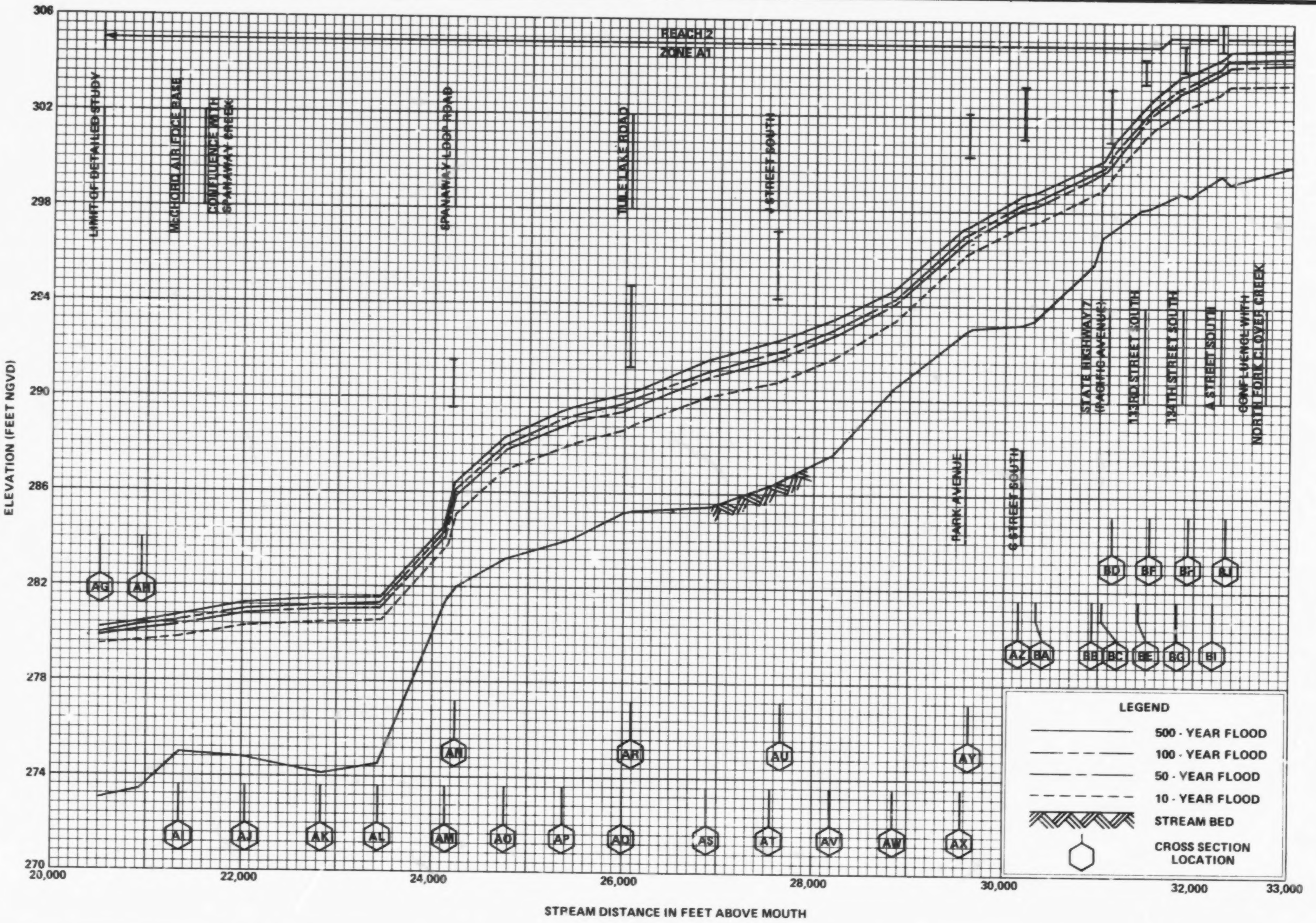

FLOOD PROFILES

CLOVER CREEK

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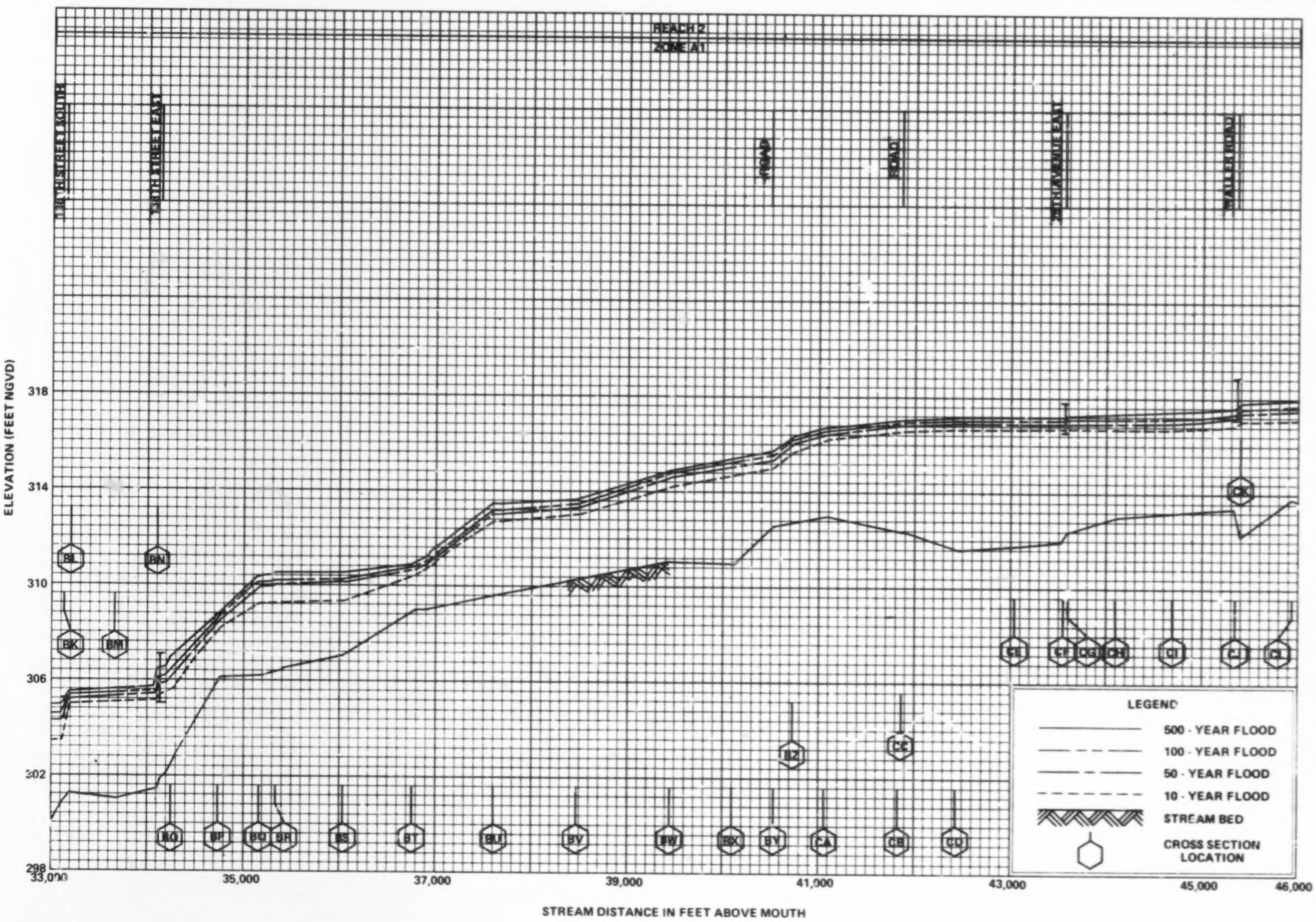

FLOOD PROFILES

CLOVER CREEK

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PIERCE COUNTY, WA
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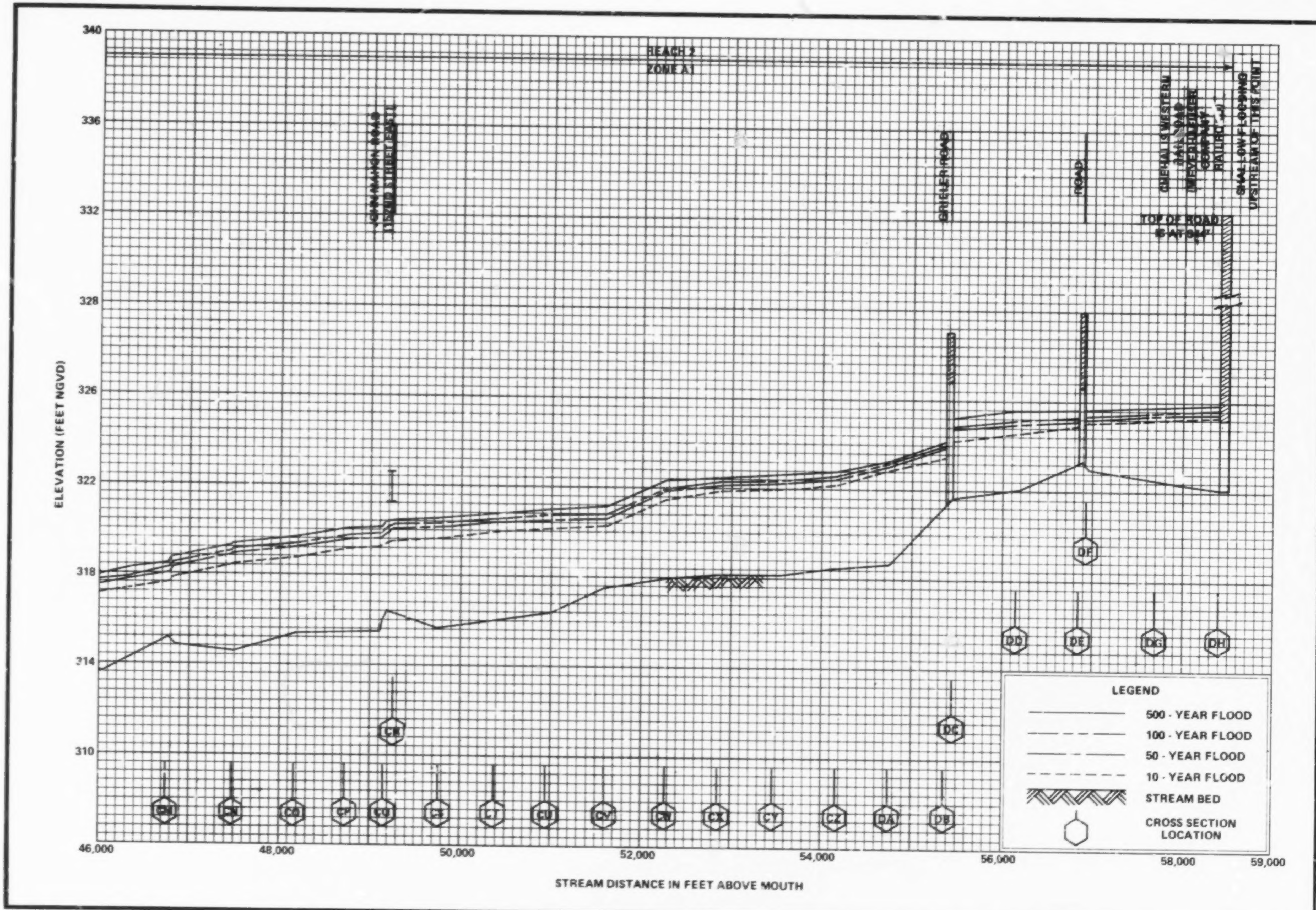

FLOOD PROFILES

CLOVER CREEK

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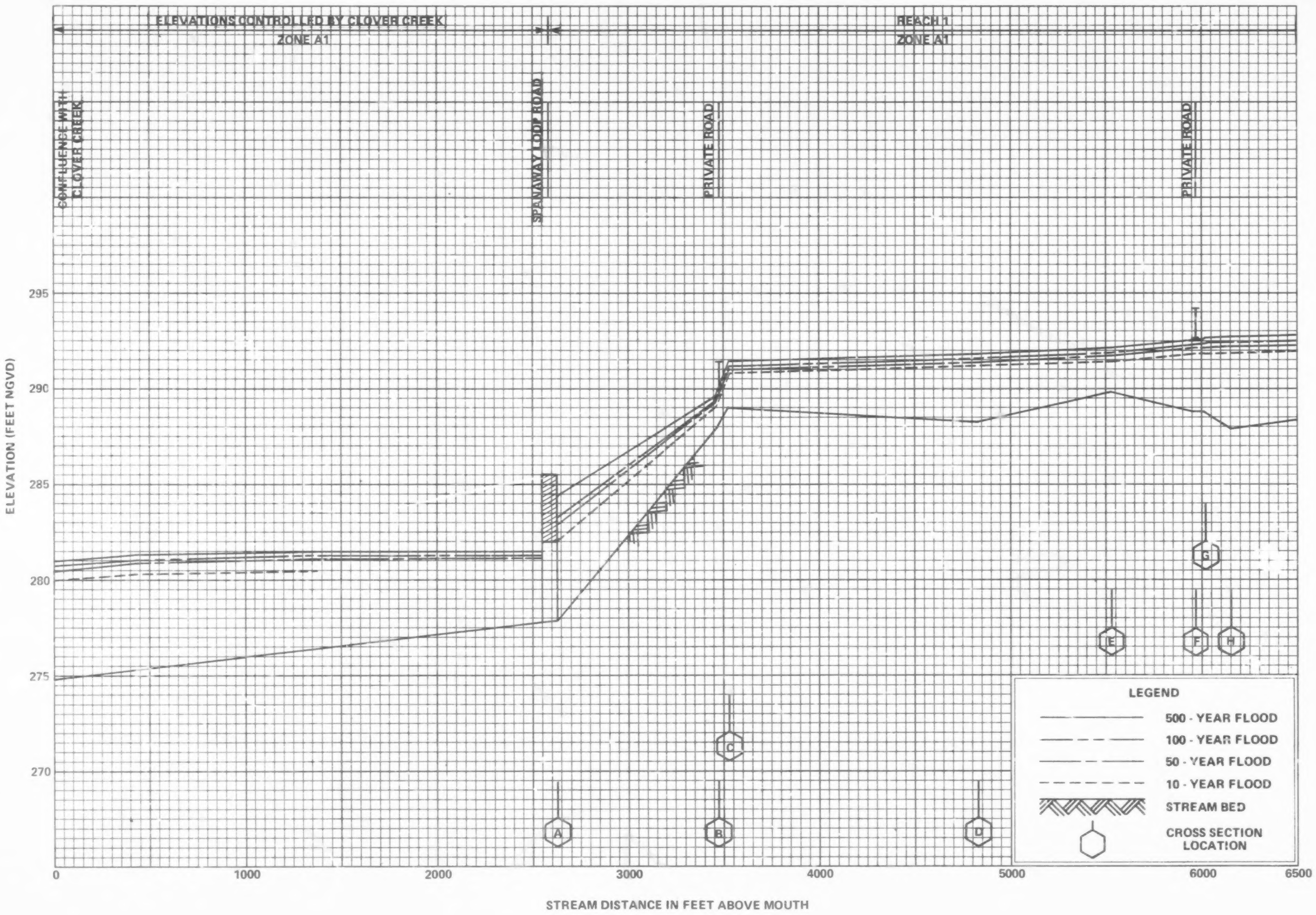

FLOOD PROFILES

SPANAWAY CREEK

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PIERCE COUNTY, WA
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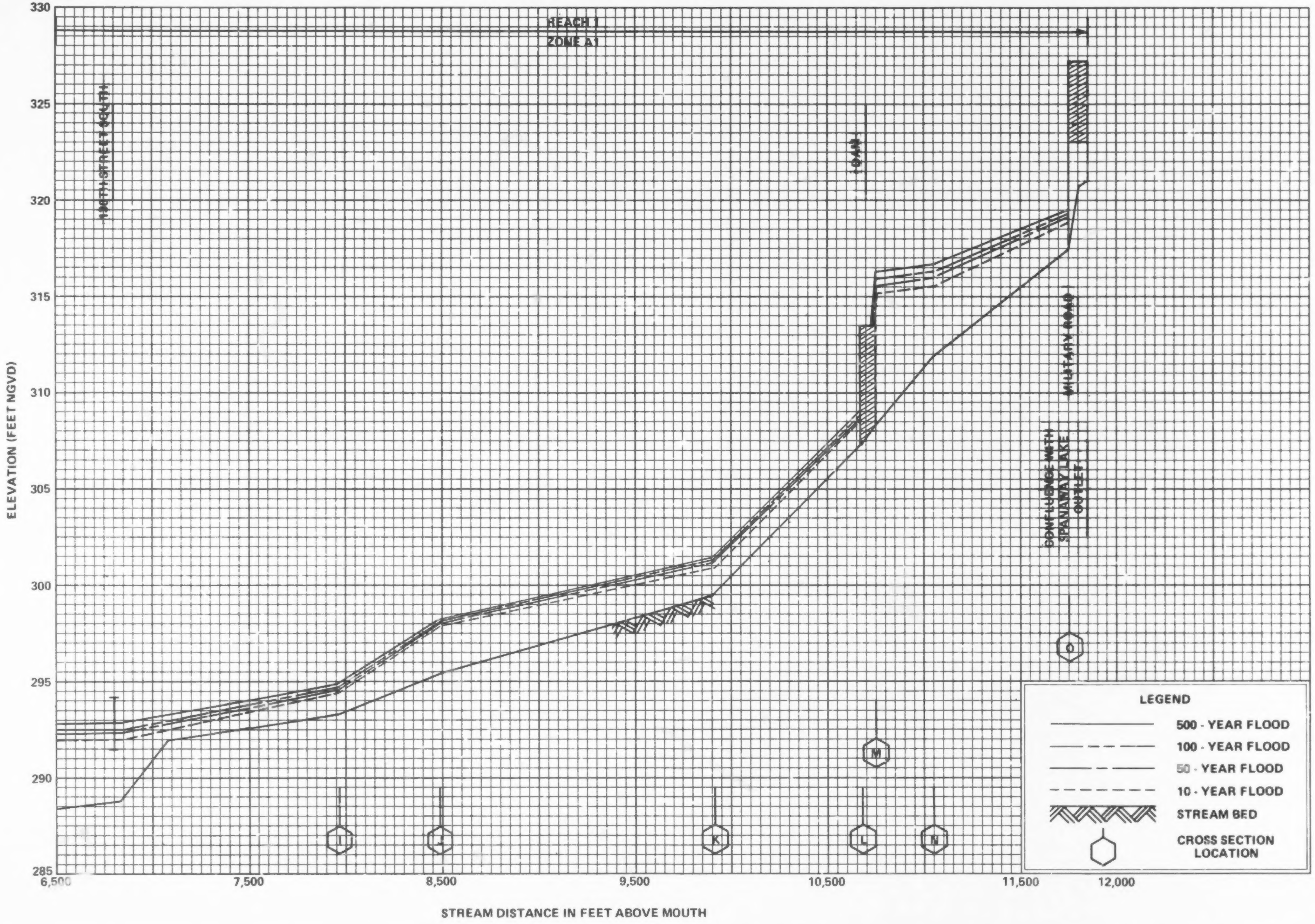

FLOOD PROFILES

SPANAWAY CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

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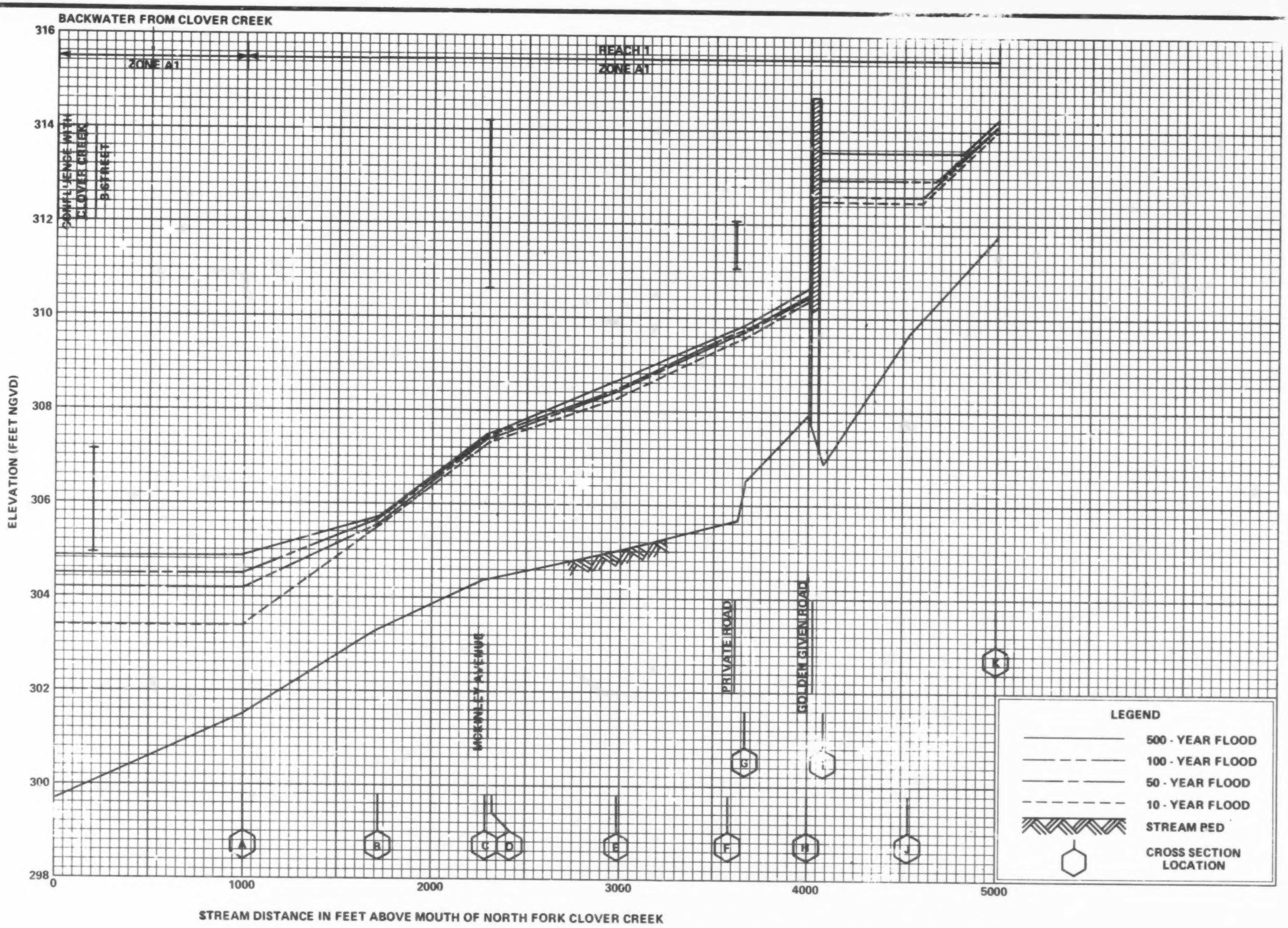

FLOOD PROFILES

NORTH FORK CLOVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

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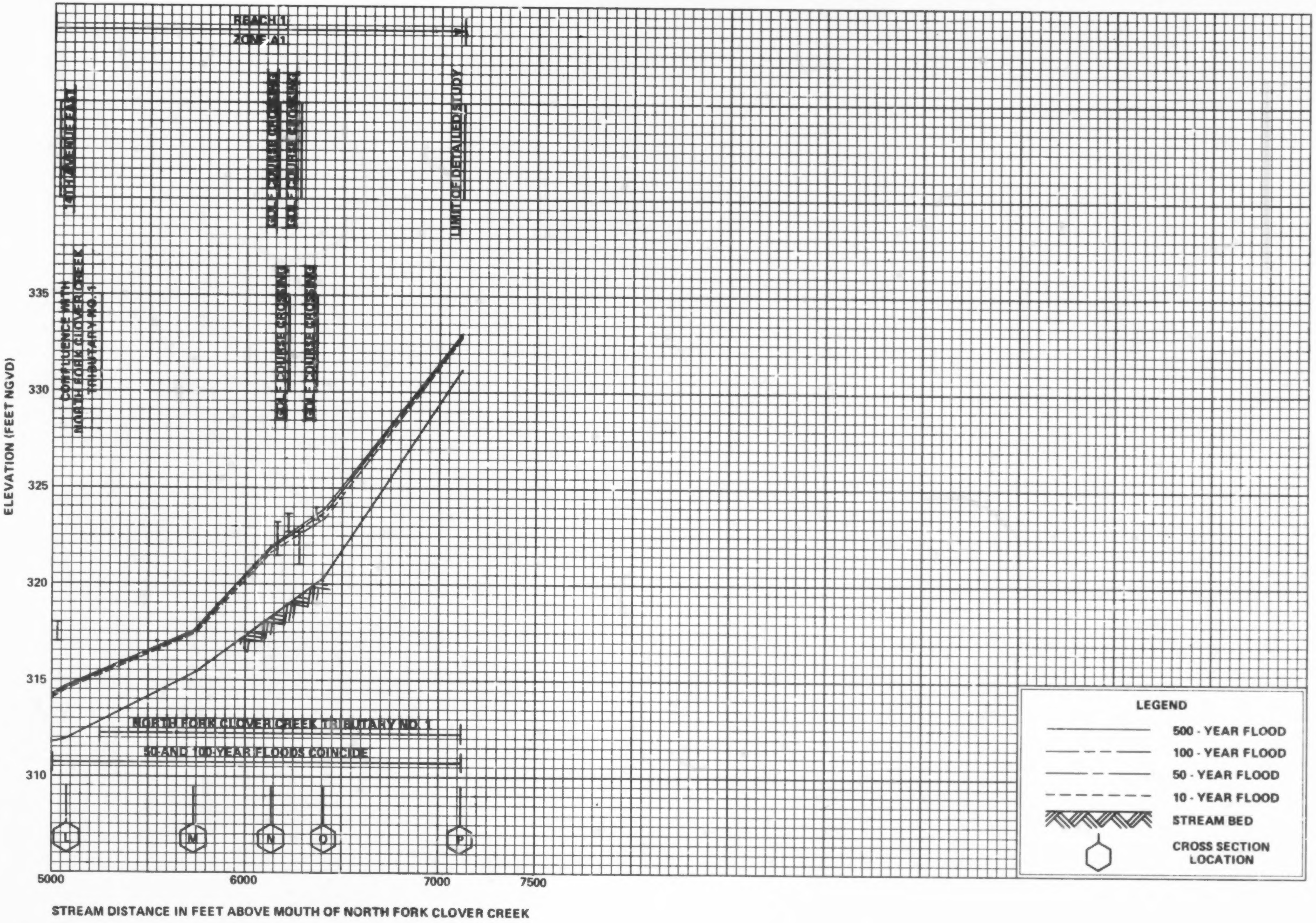

FLOOD PROFILES

NORTH FORK CLOVER CREEK

FEDERAL EMERGENCY MANAGEMENT AGENCY

PIERCE COUNTY, WA
(UNINCORPORATED AREAS)

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